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ABSTRACT

Samples of written language were collected from 140 congenitally deaf children at grade levels 3, 5, 7, and 9. The samples were then subjected to error, quantitative, and transformational analysis. Findings suggested a relationship between the order in which the deaf child acquires the rules of his language and the ordering of rules in a theoretical description of the generative process, with rules occurring early in the generative process generally being acquired earlier than rules occurring later. Furthermore, the order in which the deaf child acquired rules seemed similar to that observed in much younger hearing children. In the early stages of language development both hearing and deaf children reduced the frequency of errors in their writing more quickly than in later stages. Other findings suggested that, although the levels of performance of deaf and hearing differed markedly, differences in rate of development were not great. (Author/JD)

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Louise Todd Taylor
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SUMMARY

One version of linguistic theory has predicted that the human infant's innate capacity for acquiring language may exert a more powerful influence on the order and rate of his language development than does the environment in which he develops. The congenitally deaf child, in his singularly impoverished language environment, provides an intriguing test case for this hypothesis.

The purpose of this study was to analyze writing samples of congenitally deaf children in the attempt to answer the following questions: (1) In what order does the congenitally deaf child acquire the rules of his language? (2) What is the rate of his syntactic growth? And (3) how does his language development compare in these two respects with that of a hearing child? In the search for at least partial answers to these questions, the following study was conducted. Samples of written language were collected from congenitally deaf children at four grade levels. These samples were then analyzed in the following ways: (1) The writing was analyzed in terms of rules violated to determine what rules were not yet firmly incorporated into the deaf child's linguistic competence at particular developmental stages and to discover

in what order the various rules were acquired. (2) The writing was further analyzed in terms of the number and variety of constructions resulting from sentence combining transformations to establish the order in which the congenitally deaf child gains command of various types of transformational rules. (3) An analysis was made of the writing in terms of the quantitative indices used by Hunt, and a comparison made of the means of these measures at the four grade levels to look for evidence of syntactic development. Finally, the language performance of the deaf children as measured along these three lines was compared with that of a group of hearing children.

The findings of this study suggest certain generalizations about the order in which the deaf child acquires the rules of his language:

1. Two strict subcategorial rules appear to be acquired quite early, namely, S NP + VP and

$$\mathrm{VP} \rightarrow \begin{Bmatrix} \mathrm{Copula} + \mathrm{X} \\ \mathrm{V} + (\mathrm{X}) \end{Bmatrix}.$$

2. In the early stages of language development some congenitally deaf children's only rule for expanding VP may be VP → V(NP) (NP) with rules introducing prepositions into the VP being acquired only later.

3. The rules involved in generating determiners and auxiliaries appear to be acquired by deaf children later than those introducing the major categories.

4. Evidence indicates that deaf children begin to acquire sentence combining transformations only after they have gained a certain command over the phrase structure rules of the grammar.

5. The rules involved in coordinating constructions appear to be acquired earlier by the deaf child than the rules producing nominalizations, relatives and adverb clauses.

6. Morphological rules seem not to be acquired by the deaf child in the earliest stages of his language development.

A comprehensive view of the order in which the various rules seem to be acquired by the deaf child suggests that there may indeed be some relationship between this order and the ordering of the rules in a theoretical description of the generative process, with rules occurring early in the generative process generally being acquired earlier than rules occurring later. Furthermore, the order in which the deaf child acquires the rules of his language seems to be similar to that observed in much younger hearing children. There are, however, exceptions to both of the above generalizations.

The findings of this study on rate of development indicate that in the early stages of language development both deaf and hearing children reduce the frequency of errors in their writing more quickly than in later stages. Other findings on comparative rates of language development are inconclusive but suggest that although the levels of performance of deaf and hearing children differ markedly, differences in the rate of development are not great.

Finally, the findings of this study suggest that the techniques of analyses used herein might prove revealing in the following future research: (1) an analysis of the speech of young hearing children, (2) a longitudinal study of the language development of deaf children, (3) a comparison of the language development of deaf children exposed to different types of language instruction.

CHAPTER I

PROBLEM AND OBJECTIVES

The environment of the child profoundly deaf from birth simulates a laboratory condition which no experimenter would or could impose upon a hearing individual--silence. Whereas the hearing child is, from the day of his birth, immersed in a sea of speech--utterances well formed and ill formed, simple and complex, assertive, imperative and interrogative; the congentially deaf child is insulated from this opportunity to "learn language" by osmosis. Indeed, it has been argued by Chomsky (1965), Katz (1966), and McNeill (1966a), that the hearing child does not learn a language in the sense of inferring its structure and elements solely from the evidence provided by the language sample available to him in his environment, but rather that the child is equipped with an innate language acquisition device, a sort of unconscious knowledge of the principles of any natural language (linguistic universals), which together with the input data of the language surrounding the child enables him to acquire that language in an amazingly short time with no formal instruction. According to this theory, the congenitally deaf child possesses the same strong predisposition to acquire language as the hearing child, but fails to do so without formal instruction because of the severly restricted language input.

Thus the congenitally deaf child's peculiar language learning experience raises many interesting questions. How similar is his language acquisition process to that of the hearing child and in what ways does it differ? Are there language acquisition constraints imposed upon the human being which appear even in the order in which the deaf child in his singular environmental circumstances acquires his first language? As the deaf child matures and receives formal training in a language, does he show a growth of syntactic skills parallel to that found in hearing children? Does the language of the congenitally deaf child reflect a generative capacity by which he creates novel utterances by recombining familiar elements according to a set of rules or does it instead appear to be a set of memorized utterances or sentence patterns?

In this study, I shall be focusing on three of these questions: (1) In what order does the congenitally deaf child master the various syntactic and morphological rules of his language? (2) What is the rate of his syntactic growth? (3) How does the deaf child's order of language acquisition and rate of language development compare with the order and rate of language development reported for hearing children?

To answer any of these questions, one must first be able to describe the infinitely varied and extremely complex behavior, language, in terms of the abstract rules internalized by the native speaker, rules which enable him to understand and produce an indefinitely large number of novel sentences. Generative-transformational grammar, a formalized theory of language developed by Noam Chomsky and others, undertakes to provide such a description, by specifying a well-defined structural description for every possible sentence in a language. Moreover, this theory not only specifies structural descriptions for the well-formed sentences in a language, but also provides a possible method for characterizing the degree of deviance of ill-formed sentences (Chomsky, 1965).

Although generative-transformational grammar was developed as a linguistic, not a psychological model, it has nevertheless proved to be a valuable tool in psycholinguistic research--particularly in the areas of language acquisition and language development research. Researchers using a transformational approach such as Braine (1963), Ervin and Miller (1964) and Menyuk (1963a, 1963b, 1964a, 1964b) have demonstrated the feasibility of making inferences about the nature of a child's linguistic competence, his internalized rules for producing and understanding sentences, on the basis of a finite sample of his language performance. Furthermore, studies by Hunt (1965, 1966) and O'Donnell, Griffin, and Norris (1967), have shown that stages of language development can be charted and rate of syntactic growth measured by a transformational analysis of the language performance of children at various age levels.

As g-t grammar has led to the development of fruitful techniques of language analysis in the field of language development research, a composite version of this theory served as the theoretical framework for the present study, that is, g-t theory provided the assumptions about the nature and organization of the rules of language underlying the linguistic analysis undertaken in this research. For example, it was assumed herein that the native speaker's ability to understand and produce an infinite number of novel sentences can be described in terms of a finite set of abstract rules. It was further assumed that these rules are organized into three general components--semantic, syntactic, and phonological--and that the relationships between these three components account for the native speaker's ability to translate a string of sounds into meaning or vice versa. Moreover, it was assumed that the syntactic rules of language are of two basic types, phrase structure rules and transformational rules, with the former generating abstract deep structures, including sentences embedded within sentences, and the latter transforming these deep structures into surface structures. Finally, it was assumed that the rules of the syntactic component are ordered and that the violation of a high level rule, a rule occurring early in the generative process, results in a more deviant output than the violation of a lower level rule.

Not only was a theoretical framework similar to that of earlier transformationally oriented studies adopted in the present research, but also certain techniques of linguistic analysis developed in these earlier studies were employed in the data analysis of this study. For example, I am indebted to Hunt for his quantitative measure of syntactic maturity, mean T-unit length, to O'Donnell et al. for the technique of describing the complexity of language performance in terms of the number and types of constructions employed resulting from sentence-embedding transformations, and to Menyuk for techniques of analyzing deviances in a child's language performance in terms of rules violated. Techniques of analysis from earlier studies were adopted in this study not only because they have proved revealing with hearing samples and merit replication on other groups, but also because the findings from these earlier studies on hearing children's language could serve as a basis for comparison for the findings of this study on the language of the congenitally deaf.

Again, the three basic questions to be considered in this study are (1) In what order does the congenitally deaf child acquire the rules of his language? (2) What is the rate of his syntactic growth? and (3) How does his language development compare in these two respects with that of a hearing child? In the search for at least partial answers to these questions, the following study was designed. Samples of written language were to be collected from congenitally deaf children at four different grade levels. These writing samples were then to be analyzed in the following ways: (1) The writing was to be analyzed in terms of rules violated to determine what rules of English were not yet firmly incorporated into the deaf child's linguistic competence at particular developmental stages and to discover in what order the various rules were acquired by deaf children. (2) The writing was to be further analyzed in terms of the number and variety of constructions resulting from sentence embedding transformations to establish the order in which the congenitally deaf child gains syntactic command of various types of transformational rules. (3) An analysis was to be made of the writing in terms of the quantitative indices used by Hunt, and a comparison made of the means of these quantitative measures at the four grade levels to look for evidence of syntactic development. Finally, the written language performance of the congenitally deaf children as measured along these three lines--number of rule violations per hundred words, amount and variety of sentence embedding, and mean clause and T-unit length--was to be compared with that of a comparable group of hearing children.

Exponents of the "innateness" theory of language acquisition argue that the human infant is rather specifically programmed to learn language, this programming taking the form of "linguistic universals" with which the human being is innately endowed. Although these "linguistic universals" would impose constraints on the language acquisition process, they would not be sufficient in and of themselves to insure the child's learning a language. For such "universals" must be abstract and general enough to facilitate the child's mastery of either Bantu or Finnish with equal ease, depending on the language to which he is exposed. Thus exposure to a natural language is an essential element in the language acquisition process.

The present study investigates what happens to the language acquisition process when the primary channel for exposure to a language, audition, is peripherally blocked. In most cases this blocking of the normal input channel for language defers language acquisition until the child can be formally exposed to language through other sensory channels. Moreover, the severe restriction on language input imposed by congenital deafness may retard the rate of language development. However, the hypothesis underlying this study is that blocking the normal input channel will not affect the order in which the rules of language are acquired as this order is constrained for every human being acquiring a first language by his innate endowment.

CHAPTER II

A REVIEW OF RELATED STUDIES

Early Studies of Language Development in Deaf and Hearing Children

Since the first quarter of the twentieth century, various research studies have attempted to evaluate the language development of the deaf. However, as in the broader field of language development research in general, research into the language development of the deaf was severely restricted by the lack of a formalized linguistic theory and by the lack of precise techniques of linguistic analysis which a formalized theory of language could provide.

Lacking such a theory and such tools of analysis, early researchers were unable to address themselves to basic questions about the systematic aspects of language, the rules of language internalized by the child which enable him to understand and to produce an indefinitely large number of novel utterances. Instead, they turned their attention to various nonsystematic aspects of language, aspects which could be quantified, counted and compared though they offered but dim insight into the developing language competence of the child.

In an extensive review of all phases of child language development research up to 1954, Dorothea McCarthy (1954) reports attempts to assess language maturity in seven major areas: (1) vocabulary studies, including standard vocabulary tests, word association tests, type-token ratios, and parts of speech analyses, studies which attempt to evaluate a child's linguistic development by the size of his projected vocabulary or by its distribution among the parts of speech; (2) studies of the comprehensibility of speech with respect to articulation; (3) studies on the gross quantity of verbalization in response to a particular stimulus or situation; (4) studies on the length of response, length of response usually referring to length of sentence; (5) studies on the complexity of response, where degree of complexity is usually measured by the proportion of simple, compound and complex sentences occurring in a corpus of speech or writing; (6) error studies tabulating instances of faulty usage among children at different age levels; and (7) studies on the function of language, i.e. studies probing the Piaget hypothesis that as the child matures his language reflects a decrease in egocentrism and an increase in socialization. It is apparent that the approach in the majority of these studies is decidedly atomistic, focusing on isolated items or aspects of language rather than on the underlying language system.

Most of the studies reviewed by McCarthy were conducted on the oral language of hearing children. However, a review by Cooper and Rosenstein (1966) of the research into the language of the deaf, research based largely on written language, reveals a similar emphasis on the non-systematic aspects of language. Cooper and Rosenstein cite numerous studies which attempt to evaluate the deaf writer's language development in terms of general achievement tests, reading comprehension tests and vocabulary tests. Still other studies attempt to characterize language development by counting the occurrences in a child's speech or writing of certain linguistic items felt to be indicative of syntactic maturity. For example, counts were made of the total number of words uttered or written, the number of times the various parts of speech were used per given number of words, the number of different lexical items per number of words, the number of subordinate clauses per main clause, and the number of compound and complex sentences per given number of sentences.

Many of the studies reviewed by Cooper and Rosenstein parallel those reported by McCarthy on hearing children. These studies investigate the productivity, flexibility, complexity and correctness of the language of the deaf, often comparing their findings with the results of similar studies on the language of hearing children.

Such comparisons invariably show a general retardation in the language development of the deaf child, but rarely shed much light on the nature and extent of this language lag. Cooper and Rosenstein evaluate the research they review thusly:

> The results reported by most investigators of the language of deaf children are of limited usefulness because the data have not been related in any meaningful way to what deaf children know about language. The same observation can be made about nonlinguistic studies of child language in general (1966, p. 66).

As was asserted earlier, the problem with many of these older investigations was not that the wrong questions were being asked but rather that the technique of linguistic analysis available were inadequate to answer such questions. Until a linguistic theory was developed offering a formal characterization of the recursive devices of a language, rules in terms of which the complexities of an utterance can be described, studies of the developing complexities of children's language were limited to such superficial analyses as counting the numbers of simple, compound and complex sentences in a corpus. Until a linguistic theory was developed which made explicit the relationship between the length of a linguistic unit and its complexity, sentence length was a rather useful index of syntactic maturity with but dubious theoretical foundations. And finally, until the development of a linguistic theory which specified the ordering of rules in the generation of an utterance, studies of the errors in children's writing had no theoretical basis for judging a comma fault either more or less serious than the omission of a direct object required by a transitive verb.

However, developments in the field of linguistics in the late fifties and early sixties, specifically the work in generative-transformational grammar of Chomsky and others, provided researchers in child language development with a theoretical basis from which to investigate the system of language. To a far greater extent than any previous linguistic theory or description, g-t grammar characterizes the basic regularities of language , i. e., the formation rules and transformation rules that enable the native speaker to produce and to understand an indefinitely large number of novel sentences. Although developed as a linguistic, not a psychological model, generative-transformational grammar has served as the theoretical framework for a number of fruitful investigations into the language development of hearing children, including the descriptive child grammars of Braine and Ervin and Miller and the larger statistical studies of Menyuk, Hunt, O'Donnell et al., and Mellon.

These more recent studies have, in general, examined the child's language performance at various developmental stages in terms of three variables believed to be indicative of syntactic maturity--length of response, complexity of response and correctness of response. As in the present study I shall be looking at length, complexity and correctness of response in the writing of deaf children at four stages in their development, I should like at this point to consider related studies in these three areas.

Studies of Length of Response

One of the earliest widely used measures of length of response was sentence length. McCarthy used this measure in her 1930 study of children's language and as late as her 1954 review she still says of the measure:

> Apparently, then, sentence length is a measure which continues to show increase in normal children until maturity. The use of the measure has been criticized by some writers, and a few substitute measures have been suggested, but none seems to have superseded the mean length of sentence for a reliable, easily determined, objective, quantitative, and easily understood measure of linguistic maturity (pp. 550-551).

McCarthy further cites findings from various studies to substantiate her claim that sentence length increases as the writer matures (see Table 1).

As at the time sentence length enjoyed this reputation for reliability, it is not surprising that the Heiders in their 1940 study used sentence length as a measure of maturity in analyzing the writing of deaf children. From their findings (see Tables 1 and 2), the Heiders concluded that sentence length was a reliable index of the language maturity of the deaf as it showed a fairly steady increase with age. Moreover, they concluded that sentence length clearly discriminated between hearing and deaf writers, with hearing children consistently writing longer sentences than their deaf peers (1940, pp. 52-53).

Some twenty years later in her doctoral dissertation, Simmons (1963) still used sentence length as one quantitative index of syntactic growth in analyzing the speech and writing of deaf students. Her findings were consonant with those of the Heiders in that she too found sentence length to increase with the age of the writers at every level of development.

At first blush it would appear that McCarthy was justified in her glowing appraisal of the merits of sentence length as a measure of syntactic growth. However, at this point it would be useful to examine some of the actual quantitative findings reported in the various studies (see Tables 1 and 2).

TABLE 1.--Mean Number of Words per Sentence in the Written Compositions of Hearing Children

Age	8	9	10	11	12	13	14
Grade	3	4	5	6	7	8	9
Investigator							
Stormzand & O'Shea[a]		11.1		12.0	13.5	15.2	17.3
Heider & Heider[b]	10.2	10.9	11.1	11.1	12.8	13.7	13.9
Simmons[c]		9.3	10.0	9.8	11.5	13.6	
Hunt[d]		13.5				15.9	

[a] McCarthy, 1964, p. 550.

[b] Heider & Heider, 1940, p. 50.

[c] Simmons, 1963, p. 38.

[d] Hunt, 1965, p. 50.

TABLE 2.--Mean Number of Words per Sentence in the Written Composition of Deaf Children

Investigator / Age	9	10	11	12	13	14	15	16	17
Heider & Heider[a]			7.9	8.0	9.0	8.4	9.6	9.5	10.2
Simmons[b]	6.2	8.4	8.4	8.4	9.0				

[a] Heider & Heider, 1940, p. 50.

[b] Simmons, 1963, p. 38.

Although all studies show a general increase in sentence length as the writer matures, a careful comparison of the various findings reveals certain inconsistencies. For example, looking at the results for hearing children in Table 1, one finds a greater difference (3.4 words) between the Heiders' findings for ninth graders and the Stormzand and O'Shea results for ninth graders than there is between the performance of fourth and ninth graders in the Heiders' study. Moreover, hearing fourth graders in the Hunt study show a mean sentence equal to that of seventh graders in the Stormzand and O'Shea study and equal to that of eighth graders in the Simmons study. Finally, looking at Table 2, the results for deaf children, one finds that on the average, the deaf nine-year-olds in the Simmons study wrote sentences as long as or longer than the deaf fourteen-year-olds in the Heider and Heider study. Although some of these discrepancies can be attributed to sampling error, it seems clear that there must be some serious source of error when the findings within a single investigation seem always to come to the same conclusion, but when the raw data of one investigation is so radically different from the raw data of another.

As early as 1933, La Brant recognized one of the serious problems involved in using sentence length as an index of syntactic maturity. McCarthy reports:

> . . . she [La Brant] argued that division into sentences may be rather arbitrary, especially in the compositions of children who have not mastered punctuation and who may write several run-on clauses as a single sentence (1954, p. 550).

Although unwilling to reject sentence length as a measure of syntactic growth as did La Brant, Heider and Heider also concede difficulties in analyzing the writing of children into sentences. Furthermore, the Heiders' examples of how they analyzed poorly punctuated passages into sentences clearly demonstrate the arbitrariness of which La Brant speaks:

> *He got sick he put his hand to his head.* This is treated as one [sentence], since the subjects of the two verbs are the same.
>
> An exception was made to this rule in the few cases in which clause after clause was run together. Thus: *He went back and looked in the window and looked around and did not see anyone so he took another banana and ate it *he kept on taking it and finally he got sick *his mother came out.* In this case both clauses (*) introduced without connectives were treated as beginning new sentences (Heider and Heider, 1940, p. 51).

Although by the 1950's the inadequacies of sentence length as an index of syntactic maturity were recognized by many, few, as McCarthy points out, were able to come up with a better substitute. La Brant used clause length instead of sentence length but found, partly as a result of the way she defined clause, that although clause length could be reliably determined by analysts, it was not a sensitive index of language development. Heider and Heider (1940) examined clause length in the writing of deaf children and also found it to be nonrevealing as an index of syntactic growth.

However, in 1964, Hunt introduced the T-unit as a sensitive and reliable measure of syntactic maturity. The T-unit, or minimal terminable unit, consists of one main clause and all the dependent clauses subordinated to it (Hunt, 1965, pp. 20-22). Hunt found that written passages of students could be segmented into T-units by analysts with a high degree of reliability. Moreover, in addition to being a reliable measure, T-unit length was found to be a far more sensitive index of syntactic maturity than was sentence length, as T-unit length was not inflated at the lower grade levels by the tendency of younger writers to punctuate poorly or to coordinate numerous T-units into a single compound sentence.

In a subsequent study, Syntax of Kindergarten and Elementary School Children: A Transformational Analysis, O'Donnell, Griffin, and Norris (1967) also used T-unit length as an index of syntactic maturity in analyzing samples of oral and written language of elementary school children. However, whereas Hunt had used a thousand word corpus of free writing from each child in his study, O'Donnell et al. used much shorter passages of writing per student--passages which were collected by showing the students two films of animated cartoons without narration and then asking the students to relate the stories portrayed in the films.

Yet despite these different methods of sampling, the respective findings of the two studies concerning T-unit length are strikingly congruent. O'Donnell's findings (O'Donnell et al. 1967, p. 53) on the mean T-unit lengths of the writing of third, fifth, and seventh graders fall on an almost straight line curve connecting Hunt's findings on fourth and eighth graders (see Table 3 and Figure 1). When contrasted with the discrepancies between earlier

TABLE 3.--Mean Number of Words per T-unit in the Written Compositions of Hearing Children

Grade Investigator	3	4	5	6	7	8
O'Donnell et al.[a]	7.67		9.34		9.99	
Hunt[b]		8.4				11.5

[a] O'Donnell et al., 1967, p. 45.

[b] Hunt, 1965, p. 50.

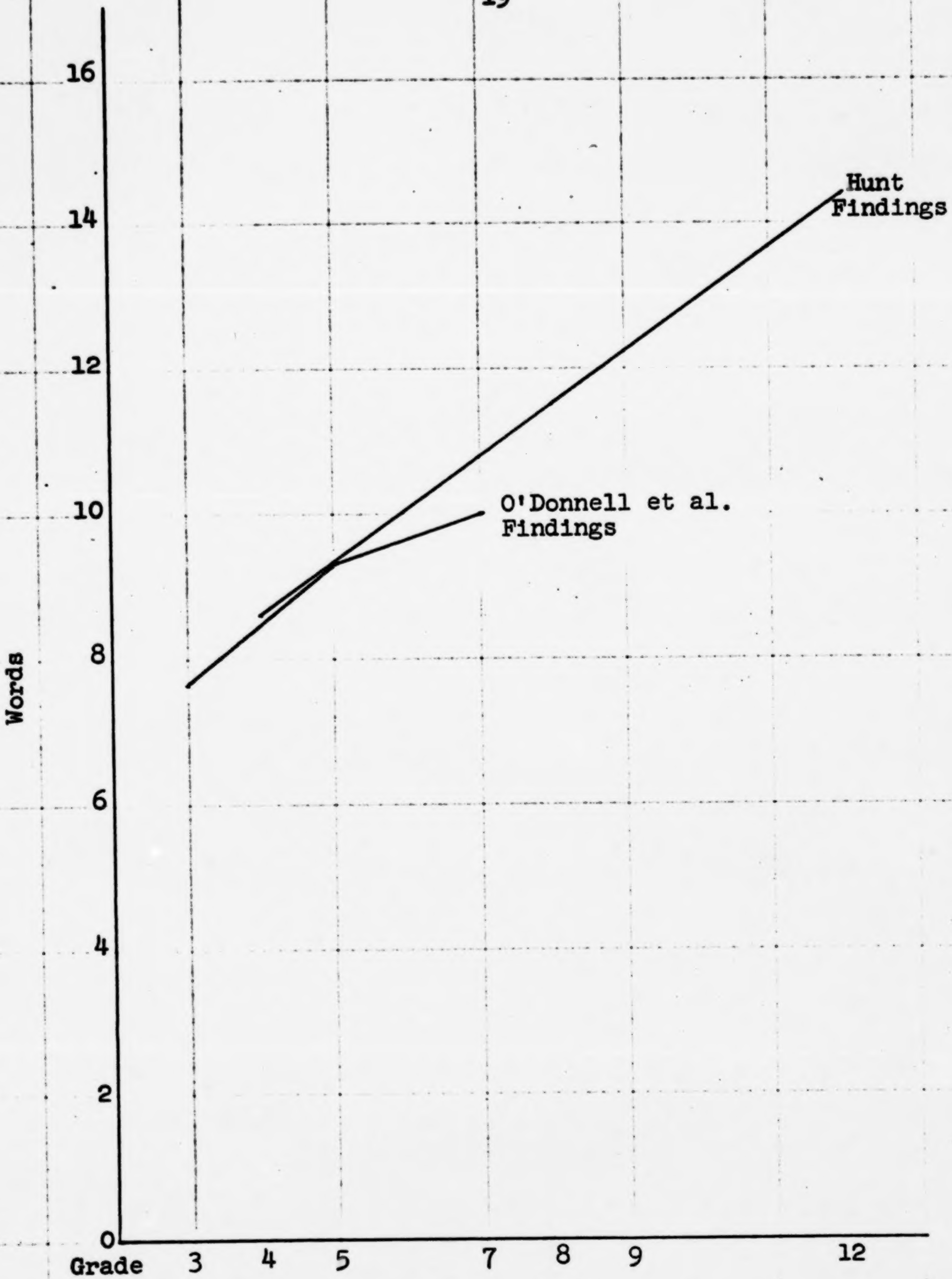

FIGURE 1.--Mean Number of Words per T-unit

studies' findings on sentence length, the consonant findings of Hunt and O'Donnell et al. offer a testimony to the usefulness of the T-unit. Concerning the T-unit's utility, O'Donnell, Griffin, and Norris make the following evaluation:

> This investigation supports the findings by Hunt (1964, 1965) that when fairly extensive samples of children's language are obtained, the mean length of T-unit has special claim to consideration as a simple, objective, valid indicator of development in syntactic control (1967, pp. 98-99).

Hunt points out that two factors contribute to increased T-unit length--the subordinate clause index, i. e., the mean number of clauses per main clause, and clause length. Among younger writers Hunt found that the former factor, the subordination index, has the greater effect on T-unit length whereas among the more mature writers the subordination index varies little and clause length is the more important factor. Thus, contrary to the findings of La Brant and Heider and Heider, Hunt discovered clause length to be a good index of syntactic maturity, particularly among older writers, though not so sensitive as T-unit length. La Brant's contrary findings may have resulted partially from her decision to count every finite predicate as a separate clause. Moreover, clause length may have proved to be a nonsignificant index in the Heiders' study because the writers they sampled were still in the early stage of language development observed by Hunt, the stage where clause length remains fairly constant and the subordination index discriminates between the more and less skilled writers.

In the present study, one of the objectives will be to examine the mean clause length and the mean T-unit length of the writing of deaf children at four grade levels. The findings from the O'Donnell - Griffin - Norris study will be used as base line data against which the results of the present study can be compared.

In addition to the empirical evidence available indicating that these two measures, clause length and T-unit length, are valid indices of syntactic maturity, we now have theoretical justification for such a claim. According to generative-transformational theory, the difference between

(a) The boy pulled the wagon.

and

(b) The chubby boy happily pulled the little red wagon that he received for Christmas down the street.

is not only that (b) is twelve words longer than (a), but also that the generation of (b) involves the use of at least two optional PS rules and four embedded S's not used in the generation of (a). Therefore it appears that clause and T-unit lengths are actually indirect measures of complexity.

Studies of Complexity of Response

Complexity of response has long been felt to be related to syntactic growth by those engaged in language development research. McCarthy in her 1930 study attempted to assess the complexity of children's speech at different age levels by categorizing all responses into one of the following six classes and then determining for each child the proportion of his utterances falling in each class:

(1) Functionally complete but structurally incomplete utterance
(2) Simple sentence
(3) Simple sentence with phrase
(4) Compound and complex sentences
(5) Elaborated sentences
(6) Structurally and functionally incomplete utterances

As her attempt to quantify complexity was a crude classificatory system, her findings were necessarily vague. McCarthy (1954, p. 554) found that as the child matured there was a general decrease in the proportion of utterances in Class 1, Functionally Complete but Structurally Incomplete, and a corresponding increase in the direction of greater complexity, i. e., in Classes 3, 4, and 5. In her 1957 study, Certain Language Skills in Children, Mildred Templin used McCarthy's classification system to analyze the complexity of the language of Minnesota school children and arrived at the same general conclusions. Heider and Heider in their analysis of the language of deaf children were also interested in probing the relationship between the maturity of the writer and complexity of response. Moreover, they too used a classificatory system and counted the number of responses in each category to assess complexity. However, their classification system was more conventional than that of McCarthy:

(1) Simple sentence
(2) Compound sentence
(3) Complex sentence
(4) Compound-complex sentence

Using this system, the Heiders (1940, p. 54) observed that among both deaf and hearing writers the proportion of simple sentences decreased and the proportion of the other three types increased with age. However, they further found that the deaf used relatively more simple and fewer compound and complex sentences than their hearing counterparts at every level and that the deaf used a majority of simple sentences at every level whereas the hearing children did not (Heider and Heider, 1940, p. 54).

These findings are not only in accord with those of McCarthy in showing a general increase in complexity of response as the writer matures but also reflect the same inability to characterize degree of complexity with any kind of precision. In both the McCarthy and the Heider and Heider ranking systems, the following two sentences would be classified as equal in complexity:

(a) The boy found the ball which was read.

(b) After searching for hours, the little boy finally found the red ball that he had lost.

Intuitively, though, any speaker of English feels that the latter is considerably more complex than the former.

The tremendous contribution of transformational grammar to this area of language development research has been to provide a theoretical basis for judging sentence (b) as more complex than (a) by providing a means for characterizing the degree of complexity of any sentence. According to g-t theory, any sentence of a language can be generated by a finite number of phrase structure rules and transformational rules. The means by which this finite set of rules is able to project the infinite number of sentences of a language is by a recursive device in the PS rules whereby a nonterminal category NTC is rewritten as S, allowing all the PS and transformational rules to operate again cyclically on this new embedded S. Thus one way to characterize the complexity of a sentence is by the number of embedded S 's. Using this means of quantifying complexity, we see that whereas sentence (a) has one embedded S, some ball was red, sentence (b) has four such embedded S's, the boy searched for hours, some boy was little, some ball was red, the boy had lost some ball.

Essentially this was the approach used to quantify complexity in the O'Donnell—Griffin — Norris study. These investigators tabulated the number of constructions resulting from sentence combining transformations per T-unit and then computed the mean number of various constructions per hundred T-units for each student, for boys and for girls at a given grade level, and for various grade levels. Having divided the constructions produced by sentence combining transformations into three categories--nominal constructions, adverbial constructions and coordinate constructions, O'Donnell et al. (1967, p. 78) discovered significant increases in all three types of constructions, in speech from kindergarten to grade seven and in writing from grade three to grade seven. In speech, all three types increased fairly steadily, if not significantly, throughout the age range. In writing, however, although adverbials and nominals increased significantly from third through seventh grade, coordinations increased significantly from grade three to grade five and then declined in grade seven. These findings indicate that the transformational approach to analyzing language complexity reveals not only the increasing ability of the more mature writer to handle more complex structures, but also permits a quantitative assessment of the complexity of students' writing at a particular grade level.

Although this approach to complexity of response is far more sensitive and sophisticated than those of earlier investigations, it is of little use in analyzing the speech of very young children, i. e., children so young that embedded constructions occur rarely if at all in their language production. It is just such a population of nursery school, kindergarten and first grade children that Menyuk investigates in her various studies (1963, 1964). In studies of children's speech elicited in various situations and of their ability to repeat various sentences, Menyuk concentrated on the transformed structures the children produced, both deviant and nondeviant. These transformed structures included not only embedded constructions, but also questions, reflexives, pronominalizations and various other single base transformations, to use the terminology of Syntactic Structures.

Menyuk found that first graders used certain transformations with a significantly greater frequency than younger children whereas the reverse was never true (1963b, p. 412) and that younger children produced significantly more deviant transformed structures than did the older ones, sometimes performing only the first step in a multi-step transformation and often overgeneralizing rules to circumstances where they did not apply (1963b, pp. 414-418). Moreover, in the case of the repetition task, the incorrect repetitions were often in the direction of developmentally earlier structures, i. e., questions were repeated as declaratives, conjoined constructions became two sentences, and if-then constructions were replaced with compound sentences usually conjoined by and (Menyuk, 1963a, p. 437). From these findings, Miss Menyuk concluded that the number of transformations in a child's repertoire and the frequency and fluency with which he uses them are the sources of complexity in a child's language and are, in addition, valid indices of syntactic maturity.

Working with children at a still more primitive stage of language development--the two word stage--Braine (1963) and Ervin and Miller (1964) attempted to characterize a child's linguistic competence at a particular stage by writing a grammar to describe a corpus of his utterances produced at that stage. Both studies reported that in the early two word stage children appear to have two classes of words, open class words (O), which have many of the properties of Fries's form words, and pivot class words (P), which resemble Fries's function words. According to both Braine (1963) and Ervin and Miller (1964), the rules which best describe these sets of two word utterances are $S \rightarrow P + O$ and $S \rightarrow O + P$, either or both of which may be in the grammar of an individual child at this developmental stage.

Of course, these children's grammars are continually changing as the child's linguistic competence approaches that of an adult native speaker. Moreover, these changes are ever in the direction of more complex language structures, structures growing out of the refinement of word classes and the elaboration of rules in the child's grammar. Thus again increasing complexity of response is an indication of syntactic growth; however, at these very early stages of language development, increased complexity of structure may result more from the addition of PS rules to the grammar than from the mastery of certain transformational rules.

In all of these transformationally oriented studies of complexity of response, the growth of syntactic control seems to be measured by the number of rules--both PS rules and transformational rules--that the child has at his command as is evidenced by his ability to produce nondeviant structures resulting from such rules. Such findings are harmonious with the opinion of Osser (1968) that the syntactic complexity of an utterance depends upon the number of optional constituents incorporated into a single sentence regardless of whether they are introduced by PS rules or transformations (p. 19).

In this study, I shall be attempting to chart the development of language of congenitally deaf children by noting the emergence of rules at various stages as indicated by the subjects' production of more and more complex structures. However, I shall be primarily interested in how the rules of the deaf writers at different age levels differ from those of the target language, English, as evinced by the consistent production of deviant structures. Furthermore, I shall be particularly interested in discovering the order in which various rules are acquired by these writers, as demonstrated by the appearance of complex structures in the writing of older students not present in the writing of younger ones and by the appearance of well formed structures in the writing of older students in place of the deviant ones used by younger writers.

Studies of Correctness of Response

A third area of language development research which has reaped benefits from the contributions of g-t grammar is the study of correctness of response. The early error studies reported in McCarthy's review merely tabulated the number of instances of incorrect usage in children's speech and generally reported the unstartling finding that a child's usage improved as the child matured.

Thompson's 1936 study of the errors in the written compositions of deaf children illustrates a problem plaguing many of these early error studies. In cataloging the deaf writers' errors, Thompson (1936, p. 96) ended up with 57 classes of errors, not all of which were mutually exclusive and none of which were hierarchical. In order to reduce this plethora of data to a more comprehensible form, Thompson grouped these 57 subclasses into four larger classes: (1) syntax and case errors, (2) clause errors, (3) words and vocabulary errors, and (4) punctuation errors. However, no clear development patterns emerged on the basis of this ordering. From this morass of data, Thompson (1936, p. 97) finally concludes that most of the errors may be characterized as being one of the following: the omission of necessary words, the use of wrong words, or the addition of excessive words. Of these three, Thompson found the omission of necessary words to be the most common error.

These three classifications of errors--omissions, substitutions, and redundancies--have since been used by other investigators of the language development of the deaf with somewhat contradictory findings. Myklebust in his The Psychology of Deafness (1960) looked at the frequency of these three types of errors in the writing of deaf and found, as did Thompson, that "the error committed by the greatest percentage of deaf children at all age levels was the omission of essential words" (Cooper & Rosenstein, 1966, p. 66). Simmons, however, in a 1962 study found the most characteristic error in the writing of deaf students to be the use of extraneous or redundant words (Cooper & Rosenstein, 1966, p. 65).

More recent work by Menyuk on the use of restricted or deviant structures in the speech of preschool children (1963b) may shed some light on the above inconsistency. Menyuk, who was also investigating the relative frequency of occurrence of omissions, substitutions and redundancies, found that different types of errors were prevalent at different stages of development. In the early stages of language acquisition before certain rules were firmly incorporated into the speaker's language repertoire, errors of omission predominated. However, in later stages as the rules were being added to the repertoire and often overgeneralized, redundancy errors became more common. Concerning this phenomenon, Menyuk says,

> There seems to be a developmental trend which resembles a damped oscillatory function rather than an asymptotic approach toward a zero usage of restricted forms. At the P.S. and morphology levels of grammar the children used rules with omissions, then rules with redundancies with decreasing amplitude (1963b, p. 414).

However, the noting of this developmental trend was not Menyuk's most singular contribution to the study of errors in children's language. In addition to tabulating the frequency of various kinds of errors, Menyuk attempted to determine what rule or rules of a grammar of English had been violated in producing the nongrammatical structures, using as her grammar of the adult or target language an early version of a g-t grammar of English.

From the findings of this type of investigation, certain inferences can be made about the nature of a child's grammar at various developmental stages. For example, Menyuk (1963b, p. 414) observed that significantly more nursery school children than first graders omitted prepositions and articles. Such an observation suggests that the rules for generating these categories, be they P. S. or transformational, are acquired by the child at a later stage of language development than the rules for generating nouns and verbs. Menyuk (1963b, p. 414) further observed that significantly more nursery school children than first graders performed only the first step or steps in relativization, pronominalization and prenominal adjective transformations, suggesting perhaps that the younger children were in the process of adding these rules to their repertoire.

Inevitably there are certain pitfalls in this kind of analysis. In the first place, the model of grammar that the investigator assumes to best describe the adult or target language may limit the kinds of observation that he can make about a child's grammar. A second and more serious problem with this kind of analysis is the difficulty in achieving analyst objectivity. In deciding what rule has been violated to produce a certain deviant structure, the analyst must often make a subjective decision about what the child intended to say or write. Nevertheless, the Menyuk studies bear witness to the fact that despite these pitfalls, insight into the language acquisition process can be gained by this approach. A similar approach to error analysis was used by Bateman and Zidonis (1964, p. 123) in analyzing the written performance of ninth and tenth grade hearing students. Moreover, it was the opinion of these investigators that a fair degree of objectivity could be achieved in such analysis.

Believing that the insight which can be achieved through an analysis of the rules violated in a writer's ungrammatical utterances outweighs any concomitant loss of objectivity, I am attempting such an error analysis in the present study. In any such undertaking, the rules which the analyst sees as violated will depend on the model of grammar he chooses to follow. In this study, I shall be using as a basic framework the fragmentary grammar presented in Chomsky's Aspects of the Theory of Syntax (1965).

In addition to analyzing errors into rules broken, I too shall be interested in classifying the various individual errors into larger categories in the hope that developmental trends will emerge. One such system of classifying violations has been proposed by Chomsky in Aspects of the Theory of Syntax (1965, pp. 148-153), a system in which violations of all rules at a certain level in the grammar are grouped together, with violations of high level rules, rules occurring early in the generative process, being regarded as more serious than violations of low level rules. Furthermore, Chomsky has tentatively proposed three levels of violations based on the structure of his fragmentary grammar--categorial errors, strict subcategorial errors and selectional errors. Although unable to handle adequately the multifarious constructions encountered in my data in terms of Chomsky's three classes, I have adopted his general approach of classifying together violations of rules which occur at the same grammatical level of at the same stage in the generative process. This classification or errors will be presented in detail in the next chapter.

David McNeill has in two theoretical monographs (1966a, 1966b) shown great interest in Chomsky's levels of rules and levels of errors as they might offer insight into the process of language acquisition. Working with various sets of language data collected from children at the two-word stage, McNeill observed that many, if not most, of these two word utterances could be classified as either NP's or VP's. Often these structures were not well formed NP's or VP's according to the adult grammar, but McNeill contends that functionally and structurally most two-word utterances fit into one of these basic categories. Further syntactic development, according to McNeill (1966a), comes as the child masters the rules and categories dominated by NP and VP and learns to combine the two into a single sentence.

On the basis of this evidence and of that from other studies on the child's acquisition of transformational rules at a much later stage in his language development, McNeill speculates that perhaps the child is innately programmed to learn language in a given order and that this order involves acquiring the high level rules before acquiring the lower ones, acquiring the abstraction NP before mastering the various surface constituents of the NP. McNeill then suggests that one interesting way to probe the question of whether there is an innately given order of language acquisition would be to investigate the language acquisition process of the congenitally deaf. Therefore in this study I shall be particularly interested in seeing whether the deaf child's acquisition of rules, as revealed in his errors at progressive stages, confirms McNeill's speculations.

In summary, the present study will attempt to assess the linguistic competence of congenitally deaf children at four grade levels by looking at length, complexity, and correctness of response in their performance on a written composition. Although previous research in these three areas has been carried out by others studying the language development of the deaf, these earlier studies were done without the benefit of the more precise techniques of linguistic analysis which have subsequently been developed. In particular, these earlier studies could not make use of the concept of T-unit length and the generative-transformational model of a grammar of English, both of which have proved to be valuable tools in language development research. Therefore in the present study I shall be employing these techniques which have been fruitful in investigating the language development of hearing children to study the growth of syntactic control in the congenitally deaf.

CHAPTER III

RESEARCH PROCEDURES

Sampling

The design of this study was to collect and analyze samples of free writing from congenitally deaf writers at four grade levels--three, five, seven and nine, and to compare their written language performance with that of a comparable group of hearing students. These four grade levels were selected for a number of reasons. For one, grade three is probably the lowest grade level at which most congenitally deaf students could perform the writing task set in the study. Moreover, many schools for the deaf do not offer a program beyond grade nine. Therefore grades three, five, seven, and nine sample the deaf student's written performance at the beginning and end of his writing career in a school for the deaf with two additional samplings at evenly spaced intermediate intervals. Yet another reason for selecting these four particular grade levels was that O'Donnell-Griffin-Norris in their study of the language development of hearing children (1967), collected and analyzed samples of writing from students in grades three, five, and seven, eliciting the writing by the same technique used in the present study. Thus, choosing grades three, five, seven, and nine in the present study facilitated comparison of the findings of this study with those of the O'Donnell, Griffin, Norris study, a study in other ways well suited to provide such normative data.

The choice of grade level as an independent variable rather than age or number of years in school presented certain problems. Three of the schools for the deaf which were sampled were either ungraded schools or used a system of grouping students different from the conventional grades found in most public schools. Moreover, even among the graded schools for the deaf, there was doubtless greater variance among schools at a given grade level than would be found among a group of public schools. That is, a student whose performance classified him as third grader in one school might have been classified as a fifth or sixth grader in another school.

Despite this variability, subjects from the graded schools for the deaf were simply sampled from the groups which each school referred to as grades three, five, seven, and nine. In the ungraded schools, however, the principal or cooperating teacher was asked to identify groups of students who would, in his judgment, be classified as third, fifth, seventh, or ninth graders in a graded school for the deaf. An additional guideline given the principal for identifying groups in the ungraded schools was that the average age of those classified as third graders should be around eleven, of fifth graders, thirteen, of seventh graders, fifteen, and of ninth graders, seventeen. By this approach, four groups of students were selected for the study who were separated by approximately two year age intervals, the mean age for deaf third graders sampled being 10.7; for deaf fifth graders, 12.8; for deaf seventh graders, 14.8; and for deaf ninth graders, 16.8.

Grade level might have been more easily, or at least more consistently defined had the subjects all been sampled from a single school for the deaf. However, because the level of the deaf child's language performance and the rate of his syntactic growth may be a function of the method of language instruction to which he has been exposed and because there are a number of competing methods of language instruction for the deaf, it was felt that a sample drawn exclusively from one school could not be considered representative of any larger population than the school from which it was drawn.

Therefore, in the attempt to increase the generalizability of the findings of this research, the subjects for this study were sampled from six different schools for the deaf employing a variety of language instruction techniques. The schools sampled included totally oral schools where no manual communication was permitted, schools employing the Rochester method of communication, in which oral speech is combined with simultaneous finger spelling, and schools in which signing was permitted both in and out of the classroom. The six schools participating in this study were the American School for the Deaf (Hartford, Connecticut), Arkansas School for the Deaf (Little Rock, Arkansas), Clarke School for the Deaf (Northampton, Massachusetts), Florida School for the Deaf (St. Augustine, Florida), North Carolina School for the Deaf (Morganton, North Carolina), and Tennessee School for the Deaf (Knoxville, Tennessee).

From each school, samples of writing were collected from as many students in grades three, five, seven, and nine as satisfied the following conditions: (1) The writers had to be congenitally deaf or if cause of deafness was unknown, the hearing loss must have been detected by the time the child was one year old. (2) Subjects had to have an average pure tone hearing loss of 70 decibels or greater in the better ear. (3) They could not be multiply handicapped. (4) They had to be of average intelligence as measured by the Leiter International Scale, the Hiskey Test of Mental Ability or some other reputable instrument.

The purpose of these four controls was twofold. The purpose of controls one and two was to insure that all students were equally deprived of exposure to oral language, for research has shown that even limited experience with spoken language, as in the case of children deafened at the age of two and a half or three, may markedly facilitate their language learning when they are placed in a school for the deaf at the age of five or six (Lenneberg, 1967, p. 155). On the other hand, controls three and four were designed to insure, insofar as possible, that any language deficit of the group sampled was solely attributable to the blocking of the aural input channel and not to other factors such as mental retardation or to the interaction of these other factors with deafness.

From the combined sample of all students from the six schools satisfying these four criteria, 35 students at each grade level were selected randomly. This sample size of 35 per grade level was chosen because it was the largest sample which could be drawn from the available pool of students that would permit both random sampling and equal representation in each cell.

After all data had been collected and the subjects at each grade level had been randomly chosen, one final screening process was carried out. Any student writing a response of fewer than twenty-five words was excluded from the sample and an alternate student was randomly selected. This minimum corpus size of twenty-five words,was arbitrarily set; however, to the author's knowledge no research has yet provided a definitive answer to the question of how large a corpus of a student's writing is needed to insure representativeness. The purpose of the twenty-five word minimum, though, was to exclude those students who apparently either did not understand the task assigned or were unequal to it and whose responses were largely repetitions of or variations on the written instructions. There was no necessity to exclude any of the hearing sample on the basis of minimum corpus size as no hearing student wrote a response of fewer than twenty-five words.

The hearing sample for this study was taken from the O'Donnell-Griffin-Norris study The Syntax of Kindergarten and Elementary School Children. In that study, writing samples were collected from thirty hearing students in grades three, five, and seven in the Murfreesboro, Tennessee public schools. Moreover, the technique used to elicit writing in that study was identical to the one used in the present study. The students in the O'Donnell-Griffin-Norris sample had no known hearing disabilities, and the average age of each grade level was approximately two years less than that of the deaf sample; otherwise, though, the two groups were roughly comparable. Like the deaf groups, the hearing groups were of average intelligence, as indicated by group means on the Lorge-Thorndike Tests (O'Donnell, Griffin, Norris, 1967, p. 30). Furthermore, none of the hearing group suffered any known handicaps which might retard the language acquisition process.

The total sample for this study consisted of 140 deaf children and 90 hearing children. A schematic presentation of the design outlined above is as follows:

Deaf Writers

n = 120

Grade	3	5	7	9
	35	35	35	35

Hearing Writers

n = 90

Grade	3	5	7
	30	30	30

Data Collection

The procedure used to collect the writing samples for this study was to show the students a silent film of an animated cartoon and then ask them to relate the story portrayed in the film. The cartoon, an 8-minute, black and white Coronet art film was an animation of Aesop's fable "The Ant and the Dove"(synopsis of film in Appexdix D).

At each school for the deaf sampled, the students viewed the film in groups of a grade at a time. Before each showing of the film, the task that the students would be asked to perform was explained to them as follows:

> You are going to see a movie called "The Ant and the Dove." Watch it carefully. After the movie, you are going to write down what happened in the movie.

After the movie the students were given a pencil and the test sheet (Figure 1, Appendix A). They were further given the following directions by the investigator:

> Put your name at the top of the paper and then write down what happened in the movie. Don't worry about spelling. Just do the best you can.

Both sets of instructions were presented orally in all schools. However, in some schools, depending on the medium of instruction, these oral instructions were supplemented by simultaneous fingerspelling or signing. In addition to these oral instructions, the following written instructions appeared on the test sheet: In your own words tell the story of "The Ant and the Dove."

After the second set of instructions, the students were given no further explanation or help. However, they were monitored throughout the writing period although no time limit was imposed for the writing task.

The writing from the hearing sample was collected by procedures similar to those outlined above. The hearing students were shown the same film, "The Ant and the Dove," without narration, and after the showing of the film they were given the same instructions as appeared on the test sheet given the deaf students. The only two differences between the data collection for the two groups were that the hearing students viewed the film in smaller groups than did the deaf students and the hearing students were asked to relate the story orally as well as in writing.

Analysis of Data

Preliminary to any analysis of the data, all writing to be analyzed was typed up in triplicate with the student's spelling and punctuation reproduced as faithfully as possible. All analysis was then done from these typescripts though the original manuscripts were occasionally consulted to resolve unclear cases which appeared as if they might stem from a student's shaky or idiosyncratic cursive script.

All data analysis in this project was carried out by graduate trainees in language development research. The author is herself such a trainee and so were all analysts working with her. Furthermore, all analysts had seen the film "The Ant and the Dove" at least twice, and like the subjects, the analysts had watched the film without benefit of narration. The purpose of familiarizing the analysts with the film was to provide them with a common basis for interpreting deviant student writing. It was felt that the analysts could more accurately and reliably interpret a subject's description of the film if they were familiar with the material being described.

The problem of this study was to answer three questions about the language development of the congenitally deaf: (1) Can an order be discerned in their mastery of the rules of the language, and if so what is this order? (2) What is the rate of their syntactic growth? And (3) how does the language development of the congenitally deaf child compare with that of the hearing child with respect to order of acquisition and rate of syntactic growth? In the attempt to answer these three questions three types of analysis were conducted on the writing samples collected--an error analysis, a quantitative analysis, and a transformational analysis. The mechanics and objectives of each of these types of analysis will be discussed individually in the order in which the three phases of the analysis were executed.

Error Analysis

The first analysis done on each paper was an analysis of the rules violated in the production of any deviant or non-grammatical structures. All such structures were interpreted in the light of the analysts' knowledge of what happened in the film which the subjects were describing. Any passages deemed uninterpretable were excluded from the analysis as well as any passages where two analysts independently arrived at conflicting interpretations. Although these uninterpretable or ambiguous passages were excluded from all subsequent analysis, the number of words excluded per hundred words written was computed for each student in the quantitative phase of the analysis.

Once the uninterpretable and ambiguous passages had been excluded, it was then necessary for the analysts to agree on which structures were ungrammatical in those passages retained for analysis and what rule or rules had been violated in the production of these ungrammatical constructions. Such a task presupposed both a standard dialect and a model of grammar describing that dialect. The dialects adopted as standard were the dialects of the analysts, which included middle class North Midland, middle class South Midland, and middle class Southern. A construction was classified as deviant only if it could not be considered grammatical in any of the analysts' dialects.

Once a construction was identified as ungrammatical, the model of grammar used to describe the nature of the deviance in terms of rules violated was a modified version of the fragmentary grammar appearing in Chomsky's Aspects of the Theory of Syntax (1965). That is, the model grammar adopted assumed that the notion of grammatical category and grammatical feature were both relevant in determining the grammaticality of an utterance, but that these two concepts, category and feature, were distinct. Secondly, this version of transformational grammar, unlike some later versions, assumed a fairly complicated base, with phrase structure rules introducing not only major categories such as noun phrase and verb phrase but also minor categories such as determiners and auxiliaries. Finally, the model grammar adopted assumed that in the generation of a sentence from initial symbol to terminal string, several different types of rules are involved, with more abstract and more basic rules occurring early in the generative process and the more superficial rules occurring later in the process. According to this view of grammar the degree of deviance of an ungrammatical utterance is related to the type of rule violated, with the violation of a high level rule, one occurring early in the generative process, resulting in the production of a more deviant structure than the violation of a lower level rule.

Chomsky treated in some detail (1965, pp. 148-153) three levels of rules which he felt occurred in the base component of the grammar--categorial rules, strict subcategorial rules and selectional rules. He argued that these three types of rules must be applied in the order listed above and that the violation of a categorial rule, for example, resulted in a more deviant structure than the violation of a strict subcategorial rule. In addition to these three types of rules, his model grammar required at least two other types of rules--transformational rules occurring in the transformational component and thus lower level rules than the three types of base rules, and morphological rules probably occurring in the phonological component and thus being even lower level than the transformational rules.

From these five types of rules, a hierarchical list of five types of rule violations can be derived. For the purposes of this study, this list was amplified into a schedule of eight types of errors. Chomsky's class of categorial errors was divided into two classes, major categorial errors and minor categorial errors. The theoretical motivation for a distinction between major and minor categories is discussed briefly in *Aspects* (Chomsky, 1965, p. 212) and is more fully elaborated by Uriel Weinreich (1966, pp. 432-4). Furthermore, two additional types of error--order errors and other errors--were added to the list. Descriptions and examples of the eight classes of rule violations used in analyzing the data are given below:

(1) *Major categorial errors* involved unacceptable functional shift, that is, the writer used one part of speech to perform the function of another, e.g.

Maj
"The ant said a happy."

Here the writer used an adjective, *happy*, in a context where the rules of English require a nominal.

(2) *Minor categorial errors* were errors involving misuse or omission of determiners and auxiliary verbs, e.g.

Min
"They fell into river,"

where a determiner has been omitted before the noun *river*; and

Min
"A man going to shoot the dove,"

where the auxiliary *is* has been omitted before *going*.

(3) *Strict subcategorial errors* involved either the generating of a category within a categorial framework where it could not grammatically occur, e.g.

SCat
"The man looks the dove,"

where the writer mistakenly combined an intransitive verb and a direct object, or the omission of a category in a context that requires it, e.g.

"He carri$\overset{\text{SCat}}{\overline{\text{ed b}}}$ack home,"

where the direct object required by carried has been omitted.

(4) Transformational errors referred in this study to errors in embedding one sentence into another, that is, failure to produce a grammatical surface form as the result of an embedding,

"The hunter points the gun at the dove which t$\overset{\text{Trans}}{\overline{\text{he dove}}}$ is asleep."

Here the writer failed to delete the dove from the surface of the relative clause.

(5) Selectional errors were defined as the co-occurrence within a construction of two items whose syntactic feature specifications are not compatible even though the categories of the two items could occur grammatically in that environment, e.g.

"The ant surprised th$\overset{\text{Sel}}{\overline{\text{e pond}}}$."

Here the verb surprise requires an object with the feature [+Animate].

(6) Morphological errors were errors in the morphographemic shape of inflected forms, e.g.

A dove ran$\overset{\text{Mor}}{\overline{\text{ned}}}$ away."

Here the writer produced the incorrect surface form of the past tense of to run.

(7) Order errors were errors in the ordering of elements which could not be analyzed in any of the preceding categories, e.g.

Ord
"Ran the ant home."

Here the normal subject verb order has been reversed.

(8) Other errors was a catchall class encompassing all deviances not accounted for elsewhere. However, over 95% of these other errors involved the choice of a wrong word which could not be classified as a selectional error, e.g.

Other
"The man shot to the dove."

Here, the writer used the preposition to instead of at, the preposition normally occurring in this construction in English.

Since these eight major classes of errors were not completely mutually exclusive, the following guidelines were established to preclude overlapping of categories:

(1) All errors involving verb inflections were analyzed as morphological except where the inflection was in error as the result of an embedding transformation's requiring a certain verbal ending. For example, in a sentence such as The dove heard the ant screamed for help (Trans), the error in verb inflection was analyzed as transformational because the complement construction requires that the verb in the embedded sentence

have either the infinitive or *-ing* ending. However, in a sentence such as *The dove heard the ant who scream* Mor *for help*, the error in verb inflection was analyzed as morphological since the relative transformation has no effect on verb endings in its domain.

(2) Whenever possible the verb inflection was made to agree in aspect with the auxiliary used by the student. That is, if the student wrote *The ant was work* Mor *hard* or *The ant was worked* Mor *hard*, the error was judged to be morphological, with the verb inflection omitted in the first instance and the wrong inflection used in the second. However, in some environments the aspect indicated by the auxiliary was so inappropriate to the context or to the events in the film that the deviance was analyzed as a minor categorial error in the choice of auxiliary, e.g., *The apple was* Min *hit the man on the head*.

(3) Whenever two verb phrases were immediately juxtaposed and the subject of the first could logically be the subject of the second, the construction was regarded as an example of a conjunction transformational error in which the conjunction had been omitted.

(4) In cases where a necessary genitive was omitted entirely, e.g., *The dove carried a leaf in* $\overset{\text{SCat}}{\text{\textit{the}}}$ *bill*, the deviance was analyzed as a strict subcategorial error on the grounds that some necessary category, either an embedded S or a genitive NP, was not generated in the base. However, in instances where the necessary genitive was included, but included without obligatory pronominalization, e.g., *The dove carried a leaf in the* $\overset{\text{Trans}}{\text{\textit{doves bill}}}$, the deviance was analyzed as a transformational error, on the grounds that the proper categories had been generated in the base but that transformations necessary to produce a correct surface form had not been performed.

The procedures by which this error analysis was actually carried out were as follows: Two analysts independently read and analyzed unmarked typescripts of each student's paper. Each analyst then excluded from the text those passages which he felt to be uninterpretable or ambiguous by overlining the passages in question. In the portion of the text retained for analysis, the analysts classified each structure they judged to be ungrammatical according to the type of error committed in producing that structure and so labeled the error in the text above the place where it occurred (See example sentences in 1-8 above).

After each analyst had completed his analysis, the two independent analyses were collated and passages where the two analysts had arrived at conflicting interpretations were excluded. In cases where the analysts agreed on the interpretation but disagreed on what error or errors had been committed, the passage in question was submitted to a third analyst for arbitration, and in the event that the disagreement could not be easily resolved, these passages also were excluded.

Finally, on a separate tally sheet (see Figure 2, Appendix A), a tally was made of the frequency of each type of error for each student. On these tally sheets, the eight major classes were broken down into subclasses, and a tally was made of the number of errors in each subclass. A breakdown of the subclasses is shown below:

Strict Subcategorial

- Omission of Direct Object
- Omission of Preposition
- Redundant Preposition
- Other

Minor Categorial

- Determiner Omission
- Aux. Ommission or Error
- Definite-Indefinite Error
- Other

Transformational

- Conjoining
- Nominalization
- Relative
- Other

Morphophonemic

- Verb Inflections
- Singular-Plural
- Possessive
- Other

Selectional

Preposition-Noun
Subject-Verb
Verb-Object
Other

Order

Subject-Verb-Reversal
Verb-Object-Reversal
Adj.- Noun-Reversal
Other

From the various tabulations of numbers of errors, the number of errors per hundred words in each class and subclass was computed for each individual student. These ratios were computed in terms of errors per hundred words instead of per T-unit or per hundred T-units because it was felt that the denominator of words permitted a fairer basis for comparing the performance of students writing very short T-units with that of students writing longer, more complex T-units. The computing and reporting of number of errors per hundred T-units would tend to penalize the student writing longer T-units. For example, if students A and B wrote the same number of words and made the same number of errors, but student A organized his material into 10 complex T-units whereas student B wrote 20 shorter T-units, then student A's ratio of errors per hundred T-units would be twice as high as stubent B's. To avoid this undesirable bias, error ratios were computed and reported per hundred words.

The purpose of the foregoing error analysis was to provide at least a partial answer to the question "In what order does the congenitally deaf child master the rules of his language?" It was believed that increasing mastery of a certain type rule would be reflected in a decreasing number of violations of this type rule per hundred words written. For example, if the deaf child acquires the rule that a noun phrase consists of a determiner plus a noun later than he acquires the rule that a sentence consists of a noun phrase plus a verb phrase, then we would expect this to be reflected in a large number of determiner omissions per hundred words in the writing of the younger children, with the ratio decreasing for older children, who are in the process of adding the later rule to their repertoire.

Quantitative Analysis

The second phase of analysis was a quantitative analysis of the writing similar to the analyses of hearing students' writing done by Hunt and O'Donnell et al. For each paper, the total number of words, of clauses, of T-units, and of sentences was counted. These counts were all based on the corpus analyzed, as any passages excluded from the error analysis were not included in any subsequent analyses. For this analysis, a word was defined as a collocation of letters treated as a single word in a conventional dictionary entry. A clause was defined as a group of words usually containing a subject and a finite verb. Assuredly, the qualification "usually containing" negatively affected the objectivity with which the preceding definition could be applied. However, because deaf children have particular difficulty with verb inflections, verbs in their writing more often than not appear in the uninflected form:

(1) Next day it wake up.

Moreover, the proclivity of deaf children to make functional shifts, possibly because of restricted vocabularies, further clouds the issue.

(2) Ant goodbye and dove goodbye to ant.

Although neither example above satisfies the strict definition of a clause, one intuitively feels that example (1) represents one clause, example (2) two clauses. And in this study they were so analyzed.

The T-unit, or minimal terminable unit, is a syntactic unit first defined by Hunt in his CRP 1998. As defined by Hunt, the T-unit is a main clause plus all dependent clauses subordinated to it. Although this unit has been used with great reliability by researchers analyzing the writing of hearing children, the application of this measure to the writing of deaf children was less clear cut. For example, by improper subject deletion, the less skilled deaf writers sometimes produced structures which satisfied the definition of a single T-unit in form, but whose form was inconsistent with the meaning the child wished to express, e.g., The hunter yelled and flew away. From viewing the film, both analysts agreed that by this sentence the child wished to communicate that the hunter yelled and the dove flew away. Such structures were analyzed as transformational errors in the error analysis and counted as a single T-unit in the quantitative analysis, the justification for this approach being that since the writer was penalized in an earlier analysis for improperly conjoining predicates to form a single T-unit, the resultant structure should then be counted as a single T-unit in subsequent analyses.

Lastly, the sentence was defined as (a) a group of words occurring between two successive instances of terminal punctuation, or as (b) a group of words occurring between one instance of terminal punctuation and a capital letter, or occasionally, as (c) a group of words occurring between two capital letters. Whenever possible, passages were segmented into sentences according to condition (a). However, when condition (a) did not hold, but condition (b) did, then (b) was used as a criterion. Condition (c) was used only in the event that neither (a) nor (b) was satisfied and the group of words satisfying condition (c) was an independent clause.

From the counts of the numbers of words, clauses, T-units, and sentences, the following averages were computed for each paper: (1) the mean number of words per clause, (2) the mean number of clauses per T-unit, (3) the mean number of words per T-unit, (4) the mean number of T-units per sentence, and (5) the mean number of words per sentence. Hunt refers to these five ratios as synopsis figures.

The purpose of obtaining these synopsis scores was twofold: (1) to provide quantitative measures of syntactic maturity which could be compared across grade levels, and (2) to provide a basis for comparing the rate of syntactic growth of the congenitally deaf writers with that of hearing students.

Transformational Analysis

The final phase of the data analysis was an identification, classification, and tabulation of all the structures resulting from embedded sentences in the writing of each student. The system used to classify these embedded structures, a modified version of that used by O'Donnell-Griffin-Norris (1967) to classify the embedded structures occurring in the writing of hearing children, is given below:

Structures Resulting From Sentence Embeddings

Structure	Example
Nominal Structures	
Headed Nominal Structures	
Noun + Noun	Home territory
Noun + Adjective	Red wagon
Noun + Possessive	The boy's problem
Noun + Relative Clause	The boy who came
Noun + Prepositional Phrase	The boy in the red shirt
Noun + Infinitive Phrase	Time to spare
Noun + Participle or Participial Phrase	The boy wearing glasses
Noun + Adverb	The lake below

Non-headed Nominals

Noun Clause	I saw that he was tired. I knew what he wanted.
Infinitive	He wanted Mary to leave.
Gerund	I couldn't understand his leaving so early.

Complements

-ing Comp.	I caught him stealing books.
Infinitive Comp.	I saw him steal the book.
Adj. Comp.	I made him angry.

Adverbial Structures

Movable Adverb Clauses

Time	Before he left, he paid his bill.
Place	Put it wherever you can find a space.
Manner	He walked as if he were lame.
Cause	He scolded us because we were late.
Condition	If he goes, I'll go with him.
Comparison	John waited longer than Tom did.
Degree	It was so cold that the water pipes froze.

Other Adverbials

Purposive Infinitive	They cheered loudly to encourage the team.

Adjective Complements

That + S	I'm sorry that you can't stay
Infinitive	I'm sorry to interrupt.
Prepositional Phrase	He was sorry about the accident.

Coordinate Structures

Coordinate Nominals	She bought a dress and a hat.
Coordinate Predicates	He started the car and drove off.
Coordinate Adjectives	He was cold and wet.
Coordinate Adverbials	Have you looked under the bed and behind the sofa?

The way in which this phase of the analysis was carried out was as follows: The principal investigator read through each paper and on the remaining unmarked typescript labeled each structure judged to be the product of an embedded sentence above the place where it occurred in the text, e.g.

Adv. Cl. N + Adj. Coor. Pred.
When the hunter yelled, the white bird woke up and flew away.

Cases where the less skilled writer had unsuccessfully combined two sentences so that the resultant structure could not be unambiguously classified were simply labeled unclear but were counted in the total number of sentence embeddings. A second analyst checked this original analysis for oversights and disagreements in analysis and then tallied the frequency of each type of embedded construction for each student on a separate tally (see Figure 3, Appendix A).

From these frequency counts, the number of each type of construction occurring per hundred T-units was computed. There were two reasons for computing and reporting these ratios in terms of T-units rather than in terms of words. In the first place, the average number of S's the writer is able to subordinate under a single dominating S is inherently more interesting than is the number of embedded S's occurring per hundred words in his writing. And in the second place, this information is reported per hundred T-units in the O'Donnell - Griffin - Norris study. Thus reporting the number of embedded structures per hundred T-units in this study facilitates comparison of the results of the two studies.

The purpose of this phase of the analysis was to chart the emergence of complex structures as they occurred in the writing of the congenitally deaf and to note any differences in variety and frequency of such structures in the writing of older students as opposed to younger ones. From these observations, the author hoped to make certain inferences about the order in which the congenitally deaf child gained control over the syntactic rules involved in incorporating one sentence as an element in another and to compare these findings with the results of similar investigations of the language development of hearing children.

Typescripts of the writing done by the hearing children in the O'Donnell - Griffin - Norris study were sent to the author by Dr. William J. Griffin, George Peabody College for Teachers, Nashville, Tennessee. Duplicate copies were made of each typescript, and the error and quantitative phases of the analysis were performed on these data in exactly the same manner as the papers from the deaf sample. However, the third phase of analysis, the transformational analysis, was not done on the hearing papers, but rather the findings of a similar analysis done by O'Donnell et al. were used as a basis of comparison for the results of this phase of the analysis on the deaf students writing.

Statistical Analysis

From the three types of analysis performed on the data, measures were obtained on 77 different variables. These variables included the five synopsis scores, total number of words written, number of words excluded from the analysis per hundred words written, plus 33 ratios of various type errors per hundred words and 37 ratios of different types of embedded constructions per hundred T-units. A complete list of these variables appears in Appendix B.

All variables, except total number of words written, were measured in terms of ratios to permit comparison between students writing passages of varying lengths. These ratios were computed by one analyst and checked by another. These data were then submitted to a computer for the following statistical analyses. One-way analyses of variance were run on every variable, with the data from the hearing group always being run separately from those for the deaf. The alpha level was set at .05, and the null hypothesis was in every case that the variance attributable to the difference between grade means was equal to zero.

In those instances where a significant F ratio was obtained, subsequent tests were made between grade levels using the Duncan Multiple Range Test.

In this study, the data on the hearing children from the O'Donnell - Griffin - Norris study was used as a kind of normative base against which the data from the deaf students could be compared. Similarities and differences between the two sets of data will be discussed and presented graphically. However, because of certain uncontrolled variables in data collection and sampling between the two studies and because there is no justification for assuming homogeneity of variance between the deaf and hearing group, the two sets of data were not amenable to statistical comparison in a two-way analysis of variance.

CHAPTER IV

FINDINGS FROM THE ERROR ANALYSIS

One goal of this study, and particularly of the error analysis, was to see if the order in which the deaf child internalizes the rules of his language could be determined. However, basic to such an investigation is the assumption that the child is indeed producing sentences by means of an internalized system of rules and not just parroting memorized phrases or sentences. Therefore one of the more important findings of this research is evidence indicating that the congenitally deaf child's language performance is the product of a system rules.

This evidence comes in the form of repeated nongrammatical constructions occurring consistently in the writing of a single child. Such structures suggest that a rule or rules idiosyncratic to that child's grammar are operating to produce predictable deviant structures in certain environments, deviant that is in terms of the target or adult grammar, not in terms of the child's grammar. One example of such idiosyncratic rules is provided by a congenitally deaf third grader whose grammar apparently included only one rule expanding the verb phrase, VP → V + NP. Thus for producing sentences of the subject-verb-object pattern, e.g., The man saw a bird, his grammar was adequate. However, whenever he attempted constructions involving verbs normally intransitive in English, his rule invariably produced such deviant structures as The ant fell a water or The ant sleep a bed, sentences in which necessary prepositions have been omitted. Moreover, in attempting to produce sentences involving intransitive verbs without prepositional phrases, this student still applied the rule VP → V + NP; however, he treated the main verb as the NP and inserted have as a placeholding pro-verb. The results were such anomalies as the following: The ant have a swimming for The ant swam and The bird have a fly for The bird flew.

Examples of such idiosyncratic rules were also found on the transformational and morphological levels. One example of an idiosyncratic transformational rule is provided by a fifth grader whose grammar apparently included a rule of the following form: Given two strings of the form $NP_1 + VP_1$ and $NP_2 + VP_2$, where $NP_1 = NP_2$, then delete NP_2 and juxtapose VP_2 immediately after VP_1. This rule results in such ungrammatical predicate coordinations as Ant walk found animals and Ant run get pin. This student produced five of these compound predicates coordinated by juxtaposition, and no instance of a predicate coordinated with a conjunction, suggesting that at this particular stage in her language development her grammar included a different rule for coordinating predicates from that of the adult model.

Idiosyncratic rules on the morphological level are exemplified by a student who apparently had his own rules for inflecting verbs. This student seemed to have an exceedingly primitive system of morphological rules, as the bulk of the verbs in his corpus were of the form is + the uninflected verb stem, e.g., Ant is jump on snail back, Ant is keep ball at home, and Father is go now. Exactly what tense or aspect these verb forms were intended to convey is not wholly clear, but in light of the task assigned, narrating the events in a film seen previously, the author conjectures that the student was writing in the simple past.

There is evidence in this student's writing, however, of a grammar in the process of transition. In addition to the ungrammatical verb forms shown above, there appeared in the same student's writing a few verbs correctly inflected for the simple past, e.g., Ant saw a father. These occasional correct past tense forms suggest that at the time the writing was collected the student was aware of certain verbs which did not conform to his general rule and that he had catalogued such verbs as exceptions, much as the adult native speaker of English catalogues the plural form of sheep as an exception to a more general rule. Moreover, one would predict that in the future this child's morphological rules will change in the following way: First, the class of exceptions to the rules will be greatly expanded. And secondly, this expansion of the class of verbs to which the child's rules do not apply will lead to a reformulation of the rules.

This isolated case illustrates in microcosm a second general finding of the study; that is, that the deaf children's language performance at the four grade levels not only implies the presence of internalized rules but further indicates that their language development is a process of gradually bringing these rules into closer and closer conformity to those of the adult model. The best index of this development in the findings of this study is the mean number of total errors per hundred words for each grade level. There is a steady though gradual decline in this index from third to ninth grade (see Table 5 and Figure 3). An analysis of variance shows the differences among grade means to be significant at the .05 level. However, subsequent Duncan Multiple Range tests show a significant difference only between grades three and nine.

This decrease in the average number of errors per hundred words is more impressive when one remembers that it is accompanied by a simultaneous increase in the complexity of writing as measured by mean clause and T-unit length (see Table 13 and Figure 11) and by the mean number of embedded structures per T-unit (see Table 15). Thus at the same time that the student is attempting more complex structures, structures involving various relatively unfamiliar transformational rules, and at the same time that he is expanding his vocabulary with lexical items whose syntactic properties he has yet to master, he is still bringing his rules into conformity with those of the adult model at such a rate that the decrease in the number of errors per hundred words is statistically significant.

The fact that indications were found of the existence of internalized rules which were gradually being brought into conformity with the rules of the adult grammar provides a somewhat firmer basis for making inferences from other findings in the error analysis about the order in which the deaf child adds various rules to his repertoire. In this phase of the analysis the declining frequency of a particular type of error at higher grade levels was regarded as evidence that in the grammars of the older children a new rule had been incorporated or an existing rule modified. In the following sections, findings from the analysis of the eight major types of errors will be discussed in terms of the light they shed on the order in which the deaf child acquires the rules of his language.

TABLE 4.--Mean Numbers of the Eight Major Types of Errors per Hundred Words

Type of Error	Grade 3 Mean	Grade 3 SD	Grade 5 Mean	Grade 5 SD	Grade 7 Mean	Grade 7 SD	Grade 9 Mean	Grade 9 SD
Strict Subcategorial	4.74	4.44	3.33	2.98	2.96	2.44	2.59	2.13
Major Categorial	.74	1.90	.49	.95	.60	.95	.26	.67
Minor Categorial	9.29	9.22	9.04	11.16	6.80	10.00	5.90	5.52
Transformational	1.56	2.04	2.39	2.61	1.97	1.86	1.99	1.47
Selectional	.38	1.46	.11	.32	.24	.45	.19	.32
Morphological	9.52	5.59	7.58	6.67	6.56	6.12	4.75	3.71
Order	1.15	3.53	.33	.73	.33	.66	.28	.61
Other	.75	1.86	.28	.65	.25	.59	.26	.58
Total	31.43	24.46	24.36	22.27	21.67	20.87	17.92	10.62

Strict Subcategorial Errors

Contrary to Chomsky's claim concerning the relationship between types of rule violations and degrees of deviance, strict subcategorial errors, errors involving omitted or redundant categories, appear to result in constructions more grammatically deviant than do violations of categorial rules, violations involving the substitution of one category for another. To the author, a sentence

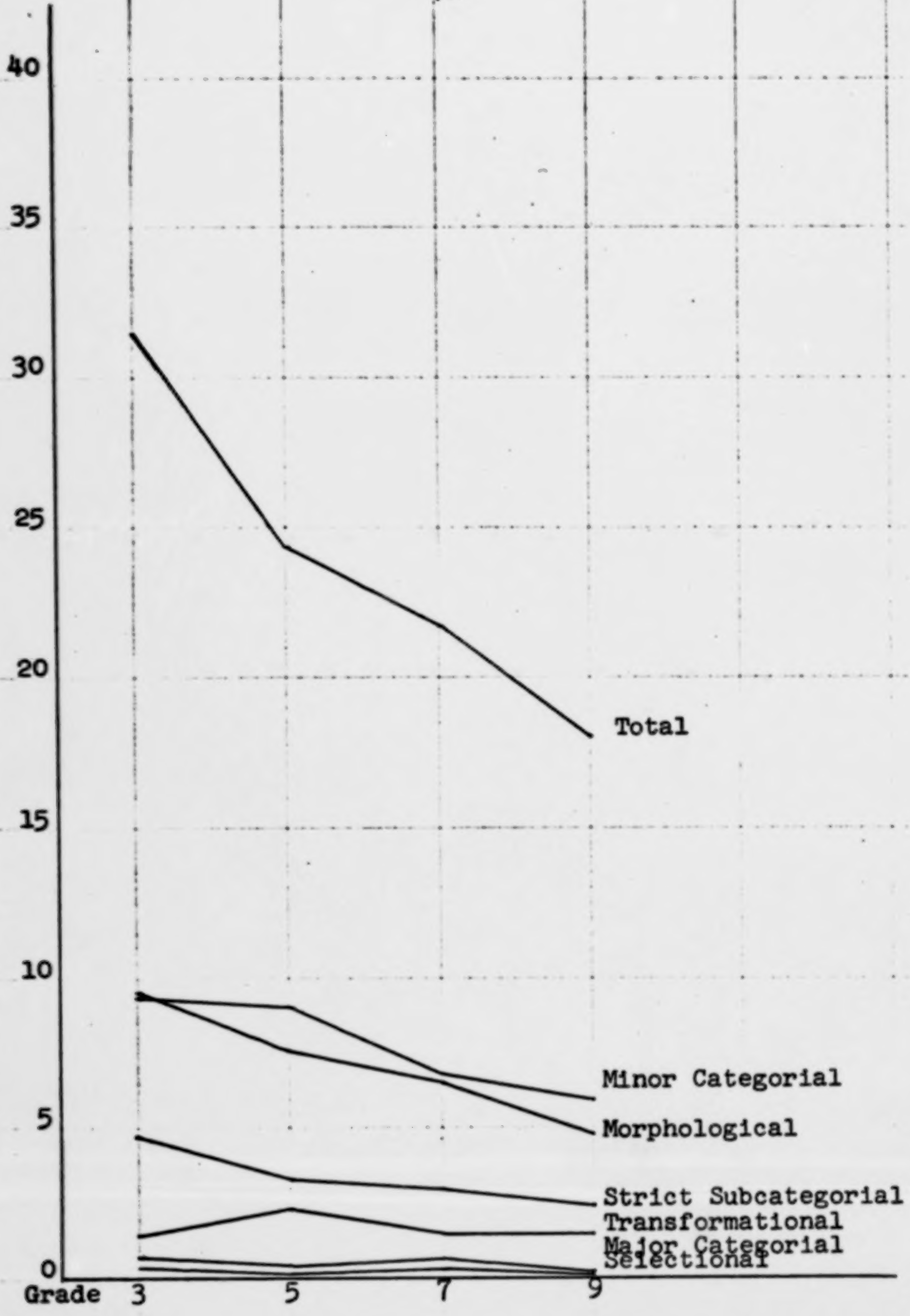

FIGURE 2.--Mean Numbers of Six Major Types of Error Per Hundred Words

such as A bird threw in the water, in which the direct object has been omitted, is intuitively more deviant than the sentence The Ant pliers his leg, in which a noun has been used in place of a verb.

However, the objective of this analysis was not to measure degrees of grammatical deviance, but rather to discover the order in which rules are acquired by the language learner and to relate the acquisition of particular rules to other milestones of language development. Moreover, the number of strict subcategorial errors per hundred words seems to be much more closely related to other aspects of language development than does the number of major categorial errors per hundred words. The mean number of strict subcategorial errors per hundred words declines at every advance in grade level (see Table 5 and Figure 3), and an analysis of variance indicates that the variance attributable to differences between grade means is significant at the .05 level, with a significant difference occurring between grade three and grade seven. This marked decline in the frequency of strict subcategorial errors between grades three and nine suggests that the addition of these rules to the child's repertoire is an integral part of his language development. In the case of major categorial errors, however, no such parallel decline is found across grade levels.

TABLE 5.--Mean Numbers of Various Types of Strict Subcategorial Errors per Hundred Words

Type of Error	Grade 3		Grade 5		Grade 7		Grade 9	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Direct Object Omission	.74	1.09	.70	.93	.22	.41	.68	1.70
Preposition Omission	1.52	1.79	1.11	1.36	1.17	1.37	1.10	1.61
Redundant Preposition	.63	1.12	.24	.54	.69	.98	.50	.58
Total Strict Subcategorial Errors	4.74	4.44	3.33	2.98	2.96	2.44	2.59	2.13

The mean numbers of strict subcategorial errors at the four grade levels suggest that mastering the strict subcategorial rules of the language, i. e., learning which categories can or must occur in which environment begins early in the language acquisition process, continues through later stages of language development as new constructions and new lexical items are added to the repertoire, and is not fully accomplished, by some students at least, even by the ninth grade. The mean number of strict subcategorial errors per hundred words for third graders (4.74) is considerably less than the mean numbers of morphological errors (9.52) or minor categorial errors

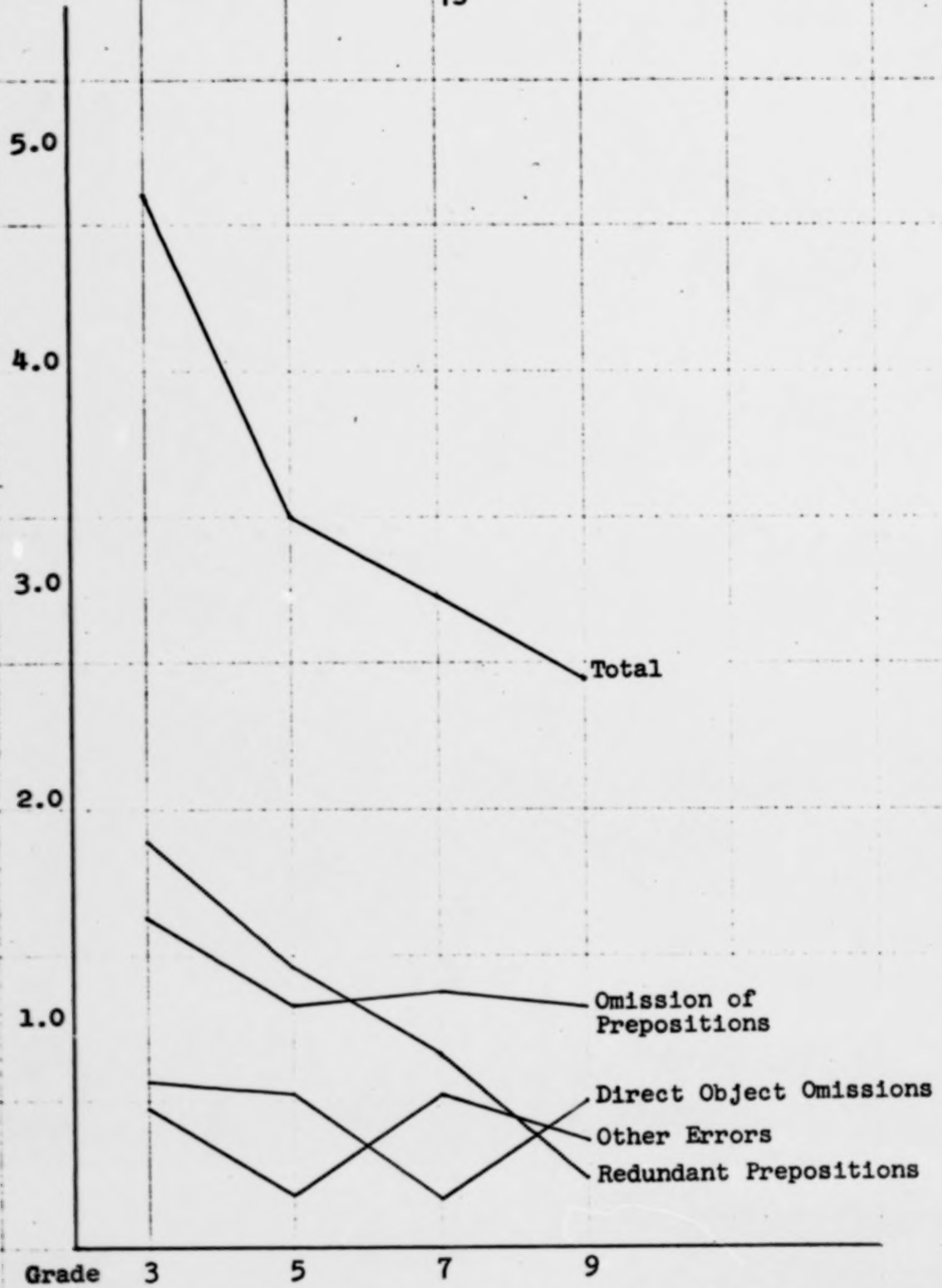

FIGURE 3.--Mean Number of Strict Subcategorial Errors per Hundred Words

(9.29), indicating that even the youngest writers surveyed had by this stage of their development established a certain command over the strict subcategorial relations of the language. Furthermore, increased control over such relations is indicated by the decreasing mean numbers of strict subcategorial errors per hundred words in grades five (3.33) and seven (2.96). It should be noted that this overall decline occurs despite the fact that certain strict subcategorial violations were on the increase during this developmental stage. Finally, the mean number of strict subcategorial errors per hundred words for ninth graders (2.59), though less than the means for the earlier grades, is still greater than the mean for any other type error except morphological and minor categorial, suggesting that even by the age of seventeen and after ten years or more of formal language instruction, some deaf students still have not established full control over these strict subcategorial relationships.

Of the two general types of strict subcategorial errors, omissions and redundancies, the former were found to be more common at every grade level, and particularly so at the lower grade levels. However, one type of omission--the omission of verb or copula--was found to be peculiarly characteristic of the early stages of language acquisition. From the entire corpus of writing analyzed, there were 50 such omissions of verb or copula, 25 of which occurred in the writing of third graders. The mean numbers of verb and copula omissions per hundred words were .69 for third graders, .13 for fifth graders, .19 for seventh graders, and .11 for ninth graders, the third grade mean being 3½ times as great as the next largest mean.

The relative infrequency of this type error at every grade level (even among third graders such errors occurred less frequently than once every hundred words) coupled with the fact that the bulk of such errors were committed by the youngest writers implies two things about the order in which the rules of language are acquired. The first implication is that in the very early stages of language development, at least some deaf children's rules for expanding the predicate do not require the inclusion of a verb. Instead, these children appear to have a sort of topic-comment grammar in which the topic is an NP and the comment may be a verb phrase, a locative, an adjective or another NP related in some unexpressed way to the topic NP. Such a topic comment relationship characterizes most of the verbless structures produced by the deaf third graders, e.g. The bird away (NP + locative), The ant happy (NP + adjective), The ant idea (NP + NP).

The second implication to be drawn from the findings on verb omissions is that one of the earliest strict subcategorial rules mastered by the deaf child is that the predicate must necessarily include a verb. Even among the deaf third graders, verb or copula omissions occurred only about 7 times in a thousand words; moreover, among fifth graders this figure had already been reduced to one such error per thousand words.

One type of strict subcategorial error deserves discussion precisely because it almost never occurred; this error is omission of subject. Although there were numerous instances of improper subject deletions resulting from various types of sentence embedding, particularly from the conjoining of predicates, there were virtually no instances of isolated VP's, of predications being made about unmentioned subjects. Although some of the most immature deaf writers produced sentences such as The ant outside or The dove idea, sentences in which the verb was omitted, there were no comparable instances of subject omissions found even in the writing of the youngest deaf children.

This finding implies that in the deaf child's language acquisition process noun phrases are somehow primary. They are, as it were, the fundamental building blocks on which the rest of the sentence structure is elaborated. That such should be the case is hardly surprising. Studies on hearing children in the very earliest stages of language acquisition, the holophrastic stage and the two-word stage, reveal that the great preponderance of the child's utterances at these stages is in the form of nouns and noun phrases (McNeill, 1966, p. 42). Brown and Bellugi (1964, pp. 138) have conjectured that one reason for this preponderance of nouns and noun phrases in the early stages of language acquisition is that these structures have more obvious referents than other categories. Another equally plausible reason is that it is patently difficult to talk without talking about something. And in the samples of writing from deaf children it appears that one of the earliest rules acquired, if not the earliest, is a rule for producing noun phrases to identify what is being talked about.

Of all strict subcategorial errors studied, omissions of prepositions occurred most frequently at all grade levels, and the reduction of such errors seemed to be closely related to increasing syntactic maturity. The mean number of preposition omissions per hundred words declines sharply between grade three and grade five and then levels out on a kind of plateau from grade five to grade nine (see Table 5 and Figure 3). However, despite the sharp decline between grades three and five, a one-way analysis of variance shows the differences between the means of the four grades to be nonsignificant.

The implication of these findings concerning the order in which rules are acquired seems to be that rules introducing prepositional phrases into the VP are added to the child's grammar later than rules introducing the direct object. That is, at a very early stage, the child seems to have a rule which expands VP as V + (NP) (NP), e.g., *The ant fell water*, *The ant slept bed*, and *Ant threw a ball the ground*. Although the majority of these NP's which are not direct objects seem to be part of locative phrases, some are from abbreviated time phrases, e.g., *He sleeped night*, some from dative phrases, e.g., *The ant talked a bird*, and still others from prepositional phrases closely associated with the verb (Chomsky, 1965, p. 102), e.g., *The ant looked the clock* and *The dove stared him*. The prepositions which have been omitted from the examples above are used in English to express certain relationships between the verb and the NP following the preposition. For example, in *The ant slept in the bed*, the preposition relates the activity of sleeping to the bed. However, the findings of this study suggest that the deaf child in the early stages of his language development depends upon the verb alone to express any such relationships. Moreover, in some cases such as *The ant waved the dove*, the verb so constrains possible relationships that the preposition is indeed highly predictable; in such cases it is almost semantically redundant, though structurally obligatory. However, in other cases, e.g., *The ant slept in the bed* versus *The ant slept under the bed*, the preposition plays a semantic as well as a syntactic role in defining the relationship between its object and the rest of the sentence.

In general, the findings of this study suggest that one measure of the deaf child's language development is his increased command over the rules and categories (prepositions) necessary to express such relationships. However, two factors related to other areas of language development complicate the picture and obscure the straight line of development which might otherwise emerge. The first is vocabulary growth. The older child who has learned that locatives following _go_ and _walk_ usually require prepositions may still omit prepositions following less familiar lexical items such as _wander_ and _arrive_, words which never result in errors for the younger students since they never use them. The second complicating factor which resulted in more errors for older writers than for younger ones is the confusion caused by lexical items which function both as adverbs and as prepositions. Many deaf writers who produced correct prepositional phrases in some environments appeared confused and hesitant about using a preposition in the immediate environment of certain adverbs which could also function as prepositions. Such students wrote _The ant fell down the water_ instead of _The ant fell down into the water_ and _The ant got up the leaf_ instead of _The ant got up on the leaf_.

Nevertheless, despite these two complicating factors, the findings of this study indicate that the omission of prepositions is more common in the early stages of language acquisition and that increased command over the use of prepositions is an index of linguistic development. That deaf children learning language should gain command over noun phrases and verb phrases before they acquire rules introducing relational categories such as prepositions is in line with Menyuk's findings on the language development of hearing children. Menyuk reported that nursery school children in her study (1963b, p. 44) omitted significantly more prepositions than did first graders, a finding which suggests an order of language acquisition in hearing children parallel to that observed in the congenitally deaf in the present study.

Furthermore, the deaf child's acquisition of rules introducing prepositions at a later stage of his language development than he acquires rules introducing noun phrases and verb phrases is consonant with one version of g-t theory. Some transformationalists (Jacobs and Rosenbaum, 1968) have argued that prepositions are not generated as categories by phrase structure rules, but rather as features of noun phrases in the deep structure. According to this theory, these features are converted into separate categories, prepositions, in the surface structure by transformational rules. Although the analysis for this study was based on older theory in which prepositions are introduced by phrase structure rules, the findings appear to support the feature approach. The older categorial grammar offers no theoretical explanation as to why prepositions should be acquired later than other lexical categories such as nouns. However, the feature approach might predict that prepositions would appear later in children's language development than nouns, on the basis that prepositions are introduced transformationally, and there is already some evidence that transformational rules are not acquired as early as phrase structure rules.

Before the analysis of the data in this study was carried out, it had been expected that omissions of direct objects would dramatically decrease with each advancing grade level and that the number of such errors per hundred words would be a good index of syntactic maturity. Such, however, was not the case. The mean numbers of direct object omissions at the four grade levels (see Table 5 and Figure 3) revealed no clear developmental trend. The mean number of such errors per hundred words showed virtually no change between grades three and five, decreased by 70% between grades five and seven, and then increased by 200% between grades seven and nine. One reason that the mean number of direct objects omissions fluctuates so from grade to grade instead of declining steadily with each advancing grade level is that there are at least three distinct sources of such errors and these three sources emerge at various developmental stages. One source of such errors, and the most important source among third graders, is ignorance about the strict subcategorial features of individual verbs. Some verbs in English may never occur in the context ___NP, others may or may not occur in such a context, and still others may occur only in the context ___NP. Not knowing that a verb was a member of this latter class resulted in direct object omissions for deaf writers at all grade levels, but seemed to cause greatest difficulty at the lower levels. Certain verbs such as put, fix, hear, see, throw, bite, pinch, bring, and drop, were frequently written by deaf students without the necessary direct object, resulting in such constructions as the following: It put on the water, The ant bit, and The dove dropped.

A second source of direct object omissions was the students' failure to include the direct object in the second of two conjoined predicates whenever that direct object was identical to the direct object in the first predicate, e.g., The dove picked a leaf and dropped in the water, or The ant got some food and brought to his home. In such cases the omission of the direct object seemed to be more of a transformational error than an error in the base rules. It appeared that many deaf students in the process of mastering the transformational rules for conjoining predicates were going through a stage where they incorrectly deleted identical objects as well as identical subjects.

This second source of direct object omissions, unfamiliarity with the process of conjoining predicates, accounts for the fact that the frequency of such omissions remains constant between the third and fifth grades. Whereas only 1/3 of all direct objects omitted by deaf third graders occurred in conjoined predicates, nearly 2/3 of such errors committed by fifth and seventh graders occurred in conjoined predicates. By the ninth grade, however, where the older students appeared to have greater command over the conjunction transformation, the fraction of direct object omissions occurring in conjoined predicates dropped to 1/2. Thus the effect of this source of direct object omissions is to inflate the number of errors in the middle grades where the students are attempting many more conjunction transformations than at the earlier stages, but have not yet acquired the mastery over such rules that they will acquire in the later grades.

The third source of direct object omissions is improper sentence embeddings other than conjoined predicates, such as The ant got the tool to pinch (for The ant got the tool to pinch the man) and Thank you for help to save from the water (for Thank you for helping to save me from the water). Proportionally more direct object omissions occurred in such embedded constructions in the ninth grade writing than in the writing of other grade level, a fact which may partially account for the increase in direct object omissions between the seventh and ninth grade. However, the number of direct object omissions in such embedded structures is not great enough to fully account for the unexpected increase in the mean number of such errors between grades seven and nine.

A fifth type of strict subcategorial error, the use of redundant prepositions, does not decline in frequency with advancing grade levels. However, the curve for the mean number of such errors per hundred words suggests a developmental pattern in the acquisition of rules similar to that observed in earlier studies on children's acquisition of morphological rules (Berko,1958), (Slobin,1966). The stages of this pattern are: (1) the omission of inflections or categories before the rule is acquired, (2) the acquisition of the rule and application of it in appropriate contexts, and (3) the overspreading of the rule to environments where it does not apply.

Applying this pattern to the deaf child's mastery of the use of prepositions, we find, as has been observed earlier, the greatest number of preposition omissions per hundred words in the writing of third graders, who have not yet acquired command of the rules for producing various prepositional phrases. However, the mean number of preposition omissions declines for the fifth grade, implying an increased control over the rules generating prepositions. Although the curve of preposition omissions remains constant from grade five to grade seven, the curve for redundant prepositions shows a sharp increase during this same period (see Figure 3), suggesting that a number of subjects have at this point entered the third phase of rule acquisition--overspreading of the rule to circumstances where it does not apply. By the ninth grade, however, the findings of this study show a decline from the seventh grade level both in the number of prepositions omitted and in the number of redundant prepositions used.

There is, however, one respect in which the curve of the mean number of redundant prepositions at the four grade levels is inconsistent with the developmental pattern of omission, acquisition and overspreading, and this is the high frequency of redundant prepositions at the third grade level. Although the author has no adequate explanation for this apparent anomaly, a partial explanation is that the third grade mean was inflated by the performance of one or two students. This fact is reflected in the large standard deviation for this variable in the third grade, a standard deviation larger than that for any other grade level.

The learning involved in reducing the number of redundant prepositions appears to be the mastery of the idiosyncratic strict subcategorial features of certain verbs and certain locative nouns. For example, the child learning English must learn that although most nouns must occur in prepositional phrases in order to form a locative, a few such as home and outdoors can also function directly as adverbs. Before such idiosyncratic features are mastered many deaf children overspread their newly acquired general rule of forming locatives by prepositional phrases, to produce such structures as The ant went to outdoors and The ant walked to home. Similarly many deaf students who have not yet learned the strict subcategorial features of the verb to thank produce structures such as He thanked to the dove, in which the VP dominating to thank is incorrectly expanded by the general rule appropriate for many similar verbs such as talk, speak, and say.

Two remaining types of strict subcategorial errors which were made infrequently by deaf writers at all four grade levels were omissions of adverbs following verbs such as put and stand whose strict subcategorial features require them and omissions of genitive nouns or pronouns in contexts where they are obligatory. The type of rule-learning involved in reducing the number of adverb omissions committed per hundred words appears to be the same as that involved in reducing the number of redundant prepositions, i.e., learning the strict subcategorial features of individual lexical items. However, the mean numbers of such errors at each grade level--.27 per hundred words for third graders, .38 for fifth graders, .14 for seventh graders, and .23 for ninth graders--produce a fluctuating curve which suggests no single developmental stage at which such strict subcategorial features are mastered by the deaf child.

On the other hand, although omissions of genitives also occur infrequently at all grade levels, the mean number per hundred words does decrease with advancing grade levels, the means being .17 for third graders, .11 for fifth graders, .10 for seventh graders, and .11 for ninth graders. This apparent increase in control over the use of genitives among deaf writers is congruent with the findings of O'Donnell et al. on the writing of hearing children that the number of possessives used increases with age. Furthermore, this reduction of genitive omissions among deaf writers is accompanied by a significant increase in their use of possessive forms, an aspect of the deaf children's language development to be discussed more fully in Chapter VI.

Major Categorial Errors

Three generalizations can be made about the findings of this study concerning major categorial errors in the writing of the congenitally deaf: (1) Such errors were relatively infrequent at every grade level. (2) The mean number of such errors across grade levels revealed no clear developmental trends. And (3) the structures resulting from such violations appeared to be far less deviant than would have been predicted on the basis of the theory concerning degrees of grammatical deviance presented in *Aspects of the Theory of Syntax* (Chomsky, 1965, pp. 148-153).

The mean numbers of major categorial errors (see Table 4 and Figure 2) show the infrequency of such errors at every grade level--in no grade does this error occur as often as once in every two hundred words. The mean numbers of major categorial errors further reveal the lack of any developmental relationship between this variable and advancing grade level. In a one-way analysis of variance on the number of major categorial errors per hundred words, the variance attributable to the difference between grade means was found to be nonsignificant.

For evidence supporting the third generalization, that structures resulting from major categorial violations are not as deviant as had been predicted, one must look at a few such structures produced by the deaf writers. Thus the following sentences, each of which occurred in the writing of one of the deaf subjects, are adduced as examples of structures resulting from major categorial errors:

1. He shooted careless.
2. The man's feet was so sound.
3. The gratitude ant waved to the dove.
4. The dove wing and went over the tree.
5. In the morning she up her eyes.
6. He got something noise.

The first observation to be made about the above sentences is that they are in most instances unambiguously interpretable as:

1a. He shot carelessly.
2a. The man's feet were so loud. (The man walked so loudly)
3a. The grateful ant waved to the dove.
4a. The dove flew and went over the tree.
5a. In the morning she opened her eyes. (She raised her eyelids)
6a. He got something noisy.

Thus the degree of deviance involved in such errors is not great enough to interfere with the reader's comprehension of the sentence, contrary to Chomsky's hypothesis that such errors would negatively affect the sentence's interpretability (1965, p. 150).

The second thing to be noticed is that substitutions similar to those found in sentences 1 through 6 occur in countless acceptable constructions. The major categorial error in sentence 1, the substitution of an adjective for an adverb, occurs more commonly in such sentences as He did real good than the more grammatical He did really well. The substitution of a noun for a verb, the major categorial error in sentence 4, is a common and highly productive process in English. Nouns such as table, clock, tree, and carpet have been freely adopted as verbs in such constructions as table the motion, clock a racehorse, tree a possum and carpet the living room. Indeed, two of the major categorial errors cited above, The dove wing and She up her eyes, can, with the proper inflections and in the proper environments, function freely as verbs, e.g., The dove winged her away across the horizon and The old man upped his prices for tourists. Thus what were counted as major categorial errors in this analysis seem to be more accurately described as substitutions closely related to the productive process of functional shift in English.

In short, the findings of this study do not confirm Chomsky's hypothesis that major categorial errors are violations of high level rules, resulting in extremely deviant structures. Instead the substitution of one major category for another seems instead to be a violation of a very low level rule. Inasmuch as the source of such errors in the case of the deaf writers appears to be a limited vocabulary, one is tempted to conjecture that such errors are related to the process of lexical insertion, a relatively late process according to most versions of g-t theory, rather than to the generation of abstract symbols in the phrase structure component. Thus the findings of this study concerning major categorial errors tend to confirm Uriel Weinreich's theoretical position (1966, pp. 432-434) that the category of a lexical item is simply one of its many features and that at the point of lexical insertion virtually any lexical item can be inserted into a slot dominated by a major category.

According to this theory, a construction such as The gratitude ant is highly interpretable for two reasons. First, although the lexical item gratitude has the wrong categorial features, all the other semantic features of this lexical entry are appropriate. And secondly, gratitude has been inserted into a slot dominated by a major category, a slot permitting virtually unrestricted lexical insertion.

Minor Categorial Errors

Minor categorial errors, the omission or misuse of determiners and auxiliaries, occurred in the writing of the deaf children at every grade level with greater frequency than any of the other seven major types of errors. However, the mean numbers of such errors per hundred words (see Table 6 and Figure 4) decline steadily with advancing grade level. Although a one-way analysis of variance shows this decline to be statistically non-significant, doubtless because of the great variance within grades, the steady decline from grade three to grade nine nonetheless suggests that some deaf students are gradually gaining control over the use of these minor categories throughout the developmental span surveyed. However, the fact that the mean number of such errors for ninth graders still comprises the largest proportion of the total number of errors shows that even after ten or more years of formal language instruction, many deaf students still have not mastered the rules involved in the use of determiners and auxiliaries.

The use of determiners seemed to give the students much more difficulty than the use of auxiliaries, as determiner omissions and definite-indefinite errors accounted for over ninety per cent of the minor categorial errors at every grade level. That control over the use of determiners is slow in coming for the congenitally deaf is reflected in the fact that determiner omissions comprise the bulk of minor categorial errors at every grade level including the ninth (see Table 6). Nevertheless, the steady, though statistically nonsignificant, decline in the mean numbers of determiner omissions with advancing grade level suggests that such control is gradually being established.

TABLE 6.--Mean Numbers of Various Types of Minor Categorial Errors per Hundred Words

Type of Error	Grade 3		Grade 5		Grade 7		Grade 9	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Determiner Omissions	6.02	8.60	6.35	9.73	5.35	9.72	4.09	5.00
Auxiliary Errors	.53	.74	.75	1.23	.57	1.03	.35	.63
Definite-Indefinite Errors	2.23	2.95	1.83	4.16	.69	1.34	1.36	2.26
Total Minor Categorial Errors	9.29	9.22	9.04	11.16	6.80	10.00	5.90	5.52

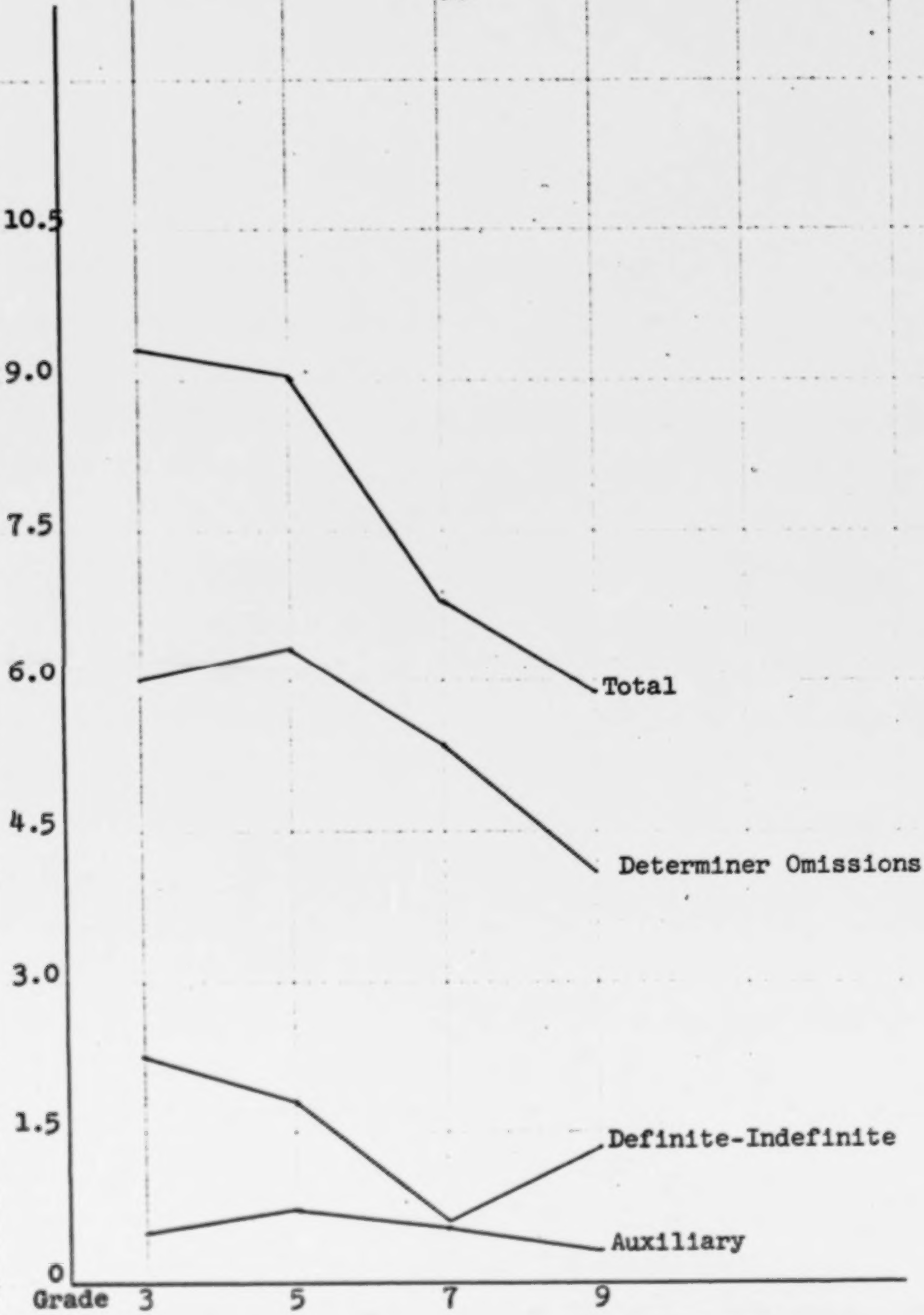

FIGURE 4.--Mean Numbers of Various Type Minor Categorial Errors per Hundred Words

However, in acquiring the rules of the determiner system, the deaf child does not make a quantum leap from complete omission to correct use of determiners. Instead, as he begins to use these categories in his writing, he appears to develop hypotheses about where to use determiners and which determiners to use, hypotheses which may later be discarded in favor of new ones as the child brings the rules in his grammar into closer conformity with those of the adult model. One hypothesis concerning where to use determiners, common to many of the younger writers, was always use a determiner before the first noun in the story. Thus many students who used determiners rarely, if at all, throughout the rest of narrative began their story with "The ant . . . ." Other students always used a determiner with the first noun in the sentence, usually the subject, but omitted the determiner before any subsequent nouns, e.g., The ant have not house, The ant walk on grass, The bird sat down on tree. Still other students appeared to follow a reverse strategy of using determiners only before nouns in the predicate and omitting them before subjects, e.g., Ant got a ball and Ant fell on the leaf. Finally some students' erratic use of determiners suggests that they were in the process of acquiring a rule which would place determiners before every noun, but that the rule was not yet firmly established in the child's repertoire. Such a state seems to best describe the rules of the deaf ninth grader who wrote the following passage:

_Ant jumped in the water. _Dove saw the ant in_water.
_Dove fly and got a leaf. A leaf fall in_water.

The choice of which determiner to use was for most students a simple binary choice between the definite article and the indefinite article as demonstratives and predeterminers rarely occurred in the writing of the deaf students sampled. Again the students' writing reflects various hypotheses being tested in the process of arriving at the correct one. Some students used only the indefinite article, a strategy that resulted in numerous definite-indefinite errors, whereas others used only the definite article, a safer strategy in terms of reducing the number of errors but hardly a superior one in terms of approximating the rule needed. At least one student distributed determiners according to the hypothesis that definite determiners should be used with the subject noun and indefinite ones with nouns in the predicate, e.g., The ant saw a bird and The bird help a ant.

The mean numbers of definite-indefinite errors decline from 2.23 per hundred words in the third grade to 1.36 per hundred words in the ninth grade, suggesting that during this developmental span some deaf students master the subtleties of when to use which article. However, as this decline in means is neither steady nor statistically significant, few other generalizations can be made from these findings about how the acquisition of the rules distributing the definite and indefinite articles fits into the larger picture of the deaf child's language development.

Compared to other types of minor categorial errors, there were relatively few errors in the use of auxiliaries committed by the deaf children sampled (see Table 6 and Figure 4). Moreover, not only were such errors infrequent, but the mean numbers of such errors across grade levels reveal no developmental trend and the variance attributable to the difference between grade means was found to be nonsignificant. However, such findings should not be interpreted as indicating that deaf children gain command over the English auxiliary early in their language development. Instead, the deaf writers in this study appeared to make few errors in the use of auxiliaries because they rarely used constructions requiring separate auxiliary segments. The bulk of their prose was written in either present indicative or simple past. They rarely wrote in the perfect or progressive aspect and almost never used passive constructions. One is tempted to conjecture that gaining control over the rules necessary to express the subtleties of aspect and voice occurs at a more advanced stage of language development than most of the deaf writers in this study had attained.

The findings from the analysis of minor categorial errors are somewhat surprising in the light of what has been observed about the language development of hearing children. It is not surprising that the use of these minor categories should emerge later in the developmental process than the use of nouns and verbs. Brown and Bellugi (1964), in their study of two hearing children in the process of acquiring language, observed that in the early stages of language acquisition the subjects consistently omitted function words, a class including determiners and auxiliaries as well as prepositions and copulas. What is surprising, however, is that deaf children should be so slow in mastering the use of determiners and auxiliaries in relationship to their acquisition of other seemingly more complex rules of the language. The child grammars of Braine (1963) and Ervin and Miller (1964) show that many of the children studied were beginning to use determiners as early as the two-word stage, forming constructions such as _the coffee_ and _a baby_ (McNeill, 1966a, p. 22). On the other hand, some deaf children who were already performing sentence embeddings such as conjoining predicates, e.g., _Ant fall and drowned in water_, still had not mastered the rules needed to produce determiners where needed.

The grammatical theory presented in _Aspects of the Theory of Syntax_ (Chomsky, 1965) offers no easy way to account for the deaf child's late and slow acquisition of the rules necessary to produce determiners and auxiliaries. In _Aspects_ these two categories are generated by phrase structure rules in the base component, rules which one might expect the child to acquire earlier than the transformational rules involved in the production of sentence embeddings.

However, more recent developments in transformational theory may offer a way of accounting for the late emergence of determiners and auxiliaries in the deaf child's language development. According to one recent version of g-t theory (Jacobs and Rosenbaum, 1968) determiners and auxiliaries are not generated as segments by phrase structure rules in the base but rather first appear as features of the major categories, nouns and verbs. Much later in the generative process these features are translated into separate categories by transformational rules. According to this view of g-t grammar, the rules introducing these minor categories as separate lexical items are not high level base rules, but comparatively low level transformational rules. Such a theoretical position offers one possible explanation as to why the deaf child acquires the rules necessary to generate auxiliaries and determiners so much later than he acquires the rules generating nouns and verbs.

One puzzling question still remains, though. Why does the hearing child's language development not reveal a parallel lag in the acquisition of the rules generating these minor categories? One can at this point only conjecture as to causes of this difference in language development. One possible explanation may lie in the fact that determiners and auxiliaries seem to be architectonic elements which are essential structurally but less significant, though not vacuous, semantically. The findings of this study suggest that for a child acquiring his first language, learning to use these surface structure elements, determiners and auxiliaries, requires extensive exposure to that language. Whereas the congenitally deaf child may form preverbal concepts for objects, activities and relationships, concepts which the acquisition of language allows him to name, he is unlikely to form preverbal concepts for determiners and auxiliaries. Because these categories are primarily elements of the language system, no amount of experience in the real world will substitute for exposure to the language in helping the child develop the rules needed to use these categories properly.

Transformational Errors

To understand the developmental picture presented by the mean numbers of transformational errors at the four grade levels (see Table 7 and Figure 5), one must look at these findings in conjunction with the findings on the mean numbers of sentence embeddings attempted at the four grade levels. The mean number of transformational errors per hundred words is lower in the third grade than at any other grade level. However, this low error ratio for the third grade indicates not that third graders have a

TABLE 7.--Mean Number of Various Types of Transformational Errors per Hundred Words

Type of Error	Grade 3 Mean	Grade 3 SD	Grade 5 Mean	Grade 5 SD	Grade 7 Mean	Grade 7 SD	Grade 9 Mean	Grade 9 SD
Conjoining	.64	1.25	1.04	2.00	.45	.67	.43	.82
Nominalization	.19	.44	.34	.66	.37	.67	.50	.68
Relative	.12	.35	.28	.49	.23	.41	.37	.65
Other	.61	1.08	.73	.89	1.40	4.22	.69	.75
Total	1.56	2.04	2.39	2.61	1.97	1.86	1.99	1.46

superior command over transformational rules but rather that third graders are attempting fewer sentence embeddings than the older students (see Tables 15 and 20).

Furthermore, the increase in the mean numbers of transformational errors between grades three and five is a reflection of increased experimentation with embedded structures not of a decreasing skill in the use of transformational rules. Indeed while the number of embedded constructions attempted increased significantly across grade levels, thereby affording more opportunities for transformational errors to be made, the mean numbers of transformational errors per hundred words increased nonsignificantly between grades three and five, and remained almost constant from grade five through nine. The fact that the

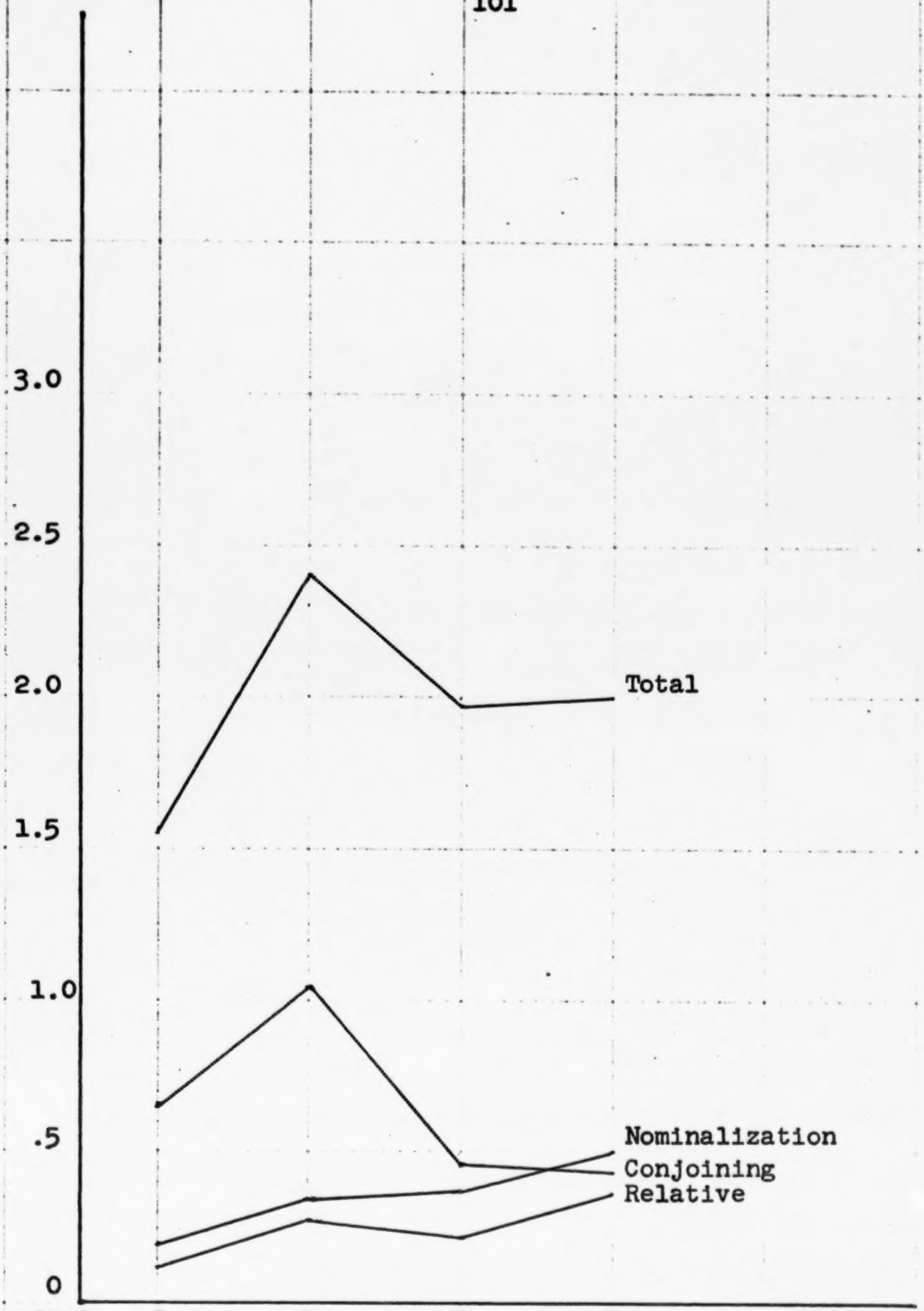

FIGURE 5.--Mean Numbers of Various Types of Transformational Errors per Hundred Words

number of transformational errors did not increase proportionally with the number of sentence embeddings attempted is indirectly indicative of the older students' increasing control over the use of transformational rules.

The most frequently occurring type of embedded structures in the writing of deaf students at all grade levels (see Table 15) were coordinations. Furthermore, in grade three errors in conjoining items were the most frequently occurring type of transformational error, accounting for 40% of all transformational errors. However, from grade five to grade nine there was a gradual decline in the mean numbers of conjoining errors per hundred words. Moreover, over this same developmental span conjoining errors account for an ever smaller proportion of all transformational errors (see Figure 5). A one-way analysis of variance shows this decline in the mean number of conjoining errors per hundred words to be statistically nonsignificant. However, when viewed in the light of the increased number of coordinated structures attempted at the upper grade levels, this decline appears to be indicative of increased control over the conjoining transformations among older writers.

The implication of these findings with respect to the order in which rules are acquired is that the deaf child's earliest attempts at combining sentences are most often attempts at coordinations and the rules involved in producing such coordinated structures are the first sentence combining transformations mastered by the deaf language learner. These findings are consonant with findings on the development of transformational rules in hearing children. Hunt (1965) reports that hearing fourth graders appear fully capable of coordinating constituents within a clause although they often miss opportunities to do so, and that by the eighth grade, hearing students are not only coordinating constituents facilely but doing so with even greater frequency than twelfth grade writers. Concerning this phenomenon Hunt writes,

> The fact that eighth graders use more coordinations inside T-units than even twelfth graders do suggests that learning to consolidate by means of coordination is a concern between grades 4 and 8, but that after grade 8 students have mastered this problem and so shift their attention more to other methods of consolidation (1965, p. 98).

In acquiring the rules involved in conjoining constituents, the deaf subjects exhibited particular difficulties with two aspects of the coordination process. One was in learning the correct use of the coordinating conjunction and the other was in learning what could be deleted when two constituents were conjoined and what could not be. Many deaf writers coordinating two or more constituents simply juxtaposed them, omitting the coordinating conjunction entirely, e.g., *I went see a tree a bird* and *Dot walk found animals*. This practice of juxtaposing constituents without a coordinating conjunction was particularly common in the case of coordinated predicates.

A few deaf writers, however, did not omit the coordinating conjunction entirely, but rather misplaced it. When coordinating a series of three or more constituents, a few subjects placed the conjunction in the series some place other than between the last and the next to the last constituent, e.g., *The ant found a ball and pushes it rolls it over in the hall* and *The dove got out of the tree and took a leaf threw it down*. Before finally mastering the most efficient method of coordinating a series--using a conjunction between the last and next to the last items in the series--the subjects appeared to pass through an intermediate phase of placing a conjunction between every constituent in the series, e.g., *The ant ran to its home and get the scissors and hit a man's leg*.

Learning exactly what was deletable in coordinating constituents posed particular difficulty for many deaf students when they attempted to coordinate predicates. Before they acquired the rule that if two sentences have identical noun phrases as subjects, then the subject of the second sentence may be deleted and its predicate conjoined to that of the first, many deaf writers appeared to conjoin predicates according to the following rule: If the subject of a sentence is identical to any noun phrase in the preceding sentence, then that subject may be deleted and its predicate conjoined to the predicate of the preceding sentence. Deaf students whose rule for conjoining predicates was apparently similar to the rule outlined above produced such structures as *The tool hurt the hunter and yelled* and *The hunter scared the dove and flew away*.

In addition to learning that in conjoining predicates the subject NP can be deleted only if it is identical to the subject NP of the preceding sentence, the deaf writers also had to learn that in conjoining predicates the subject is the only deletable constituent. Many deaf writers also deleted the object of the conjoined predicate if it was identical to the object in the preceding sentence, e.g., *The ant threw a ball on the ground and put in his room*. Some deaf writers consistently omitted verb inflections in the second of two coordinated predicates, e.g., *The ant went off and ride the dragonfly*. Parenthetically, this same error has been observed in the dialect of some culturally disadvantaged hearing children (Davis, 1969, p. 6). Finally, some deaf writers deleted not only the subject but also the verb of the second sentence, leaving only an adverbial phrase or direct object of one sentence to be coordinated with the full predicate of another, e.g., *But it got a leaf floated and back on the ground* and *The ant walked and goodbye to bird*.

Nominalizations

Nominalization transformations appeared to present particular difficulty to deaf writers at all four grade levels. As the mean numbers of nominalizations attempted increased with advancing grade level (see

Table 16), the mean numbers of errors in nominalizations increased concomitantly (see Table 7 and Figure 5). Although this increase in frequency of nominalization errors is neither statistically significant nor so great as to be proportional to the increase in nominalizations attempted, still the steady increase in such errors over a six year span of formal instruction in language, is indicative of the difficulty encountered by the deaf child in gaining command over the various transformational rules involved in producing nominalized sentences.

One source of this difficulty is the obligatory transformation of the verb forms in gerunds and infinitives. Whereas the deaf child mastering the rules for conjoining predicates or forming relative clauses need make no changes in the verb form of the embedded sentence, the child attempting to transform embedded sentences dominated by NP's into grammatical surface structures must learn (1) that in two out of three types of nominalization the verb form in the nominalized sentence must be changed to a nonfinite form and (2) that the environment often dictates which type of nominalization must be used.

Some deaf writers who had yet to learn that changes in the verb form were often required in nominalizations simply left the embedded sentence in its finite form, thereby producing such ungrammaticalities as *The bird saved a ant by the bird carried a leaf* and *at first story [was] about an ant found the ball*. (Such ungrammatical constructions tend to confirm the theoretical position that nominalizations in the surface structure are at some deeper level embedded sentences dominated by NP's.) Other deaf students were apparently aware of the need to change the verb form but were uncertain as to how to change it. Such subjects produced hybrid nominalizations in which the verb appeared to be a cross between the finite and nonfinite form, e.g., *The ant like to played with insect*, *The man began screamed* and *The man tried to shot it*. Still others were able to produce both gerunds and infinitives but were unsure as to which type of nominalization was called for in a particular context. The following sentences written by deaf students exemplify such confusion: *He cannot know how swimming* and *The hunter missed to shoot the dove*. The deaf child's struggles with the complexities of English nominalization transformations are epitomized in the following sentence: *The dove helped it from keeping to drown*.

Although noun clause constructions require no special verb form, this type of nominalization presented one problem for some deaf writers. This problem was the tendency to generate redundant NP's between the verb *to see* and a noun clause used as direct object, e.g., *The ant saw him what he was doing* and *The ant saw him that he would be going to kill the dove*. Two possible sources of such constructions are (1) they are formed on analogy to complement structures such as The sergeant ordered the men to leave or (2) they reflect the deaf child's knowledge that if one sees the doing of something, one almost invariably sees the doer as well. For whatever reason, however, this problem of the redundant NP before clausal direct objects of the verb to see plagued a number of deaf writers, particularly when the noun clause was an embedded question.

The findings on nominalization errors in the writing of deaf children offer three implications about the rules of his language. First, the infrequency of both deviant and correct nominal structures in the writing of the younger students implies that rules related to nominalization transformations are acquired comparatively late in the language development process. Secondly, the increasing frequency of such errors with each advance in grade level implies that the deaf child encounters great difficulty in acquiring the numerous and varied rules involved in English nominalizations, much greater difficulty than he encounters, for example, in acquiring the rules involved in conjoining predicates. Finally, the fact that the ratio of nominalization errors to nominalizations attempted is comparatively high even in the writing of the oldest deaf subjects, suggest that many congenitally deaf students never acquire the full complement of nominalization rules.

Relative Clause Errors

Like nominalization errors, relative clause errors are comparatively infrequent at every grade level, occurring only about once in every 300 words even in the ninth grade, where such errors are most common (see Table 7 and Figure 5). However, relative clauses attempted by deaf writers are also infrequent. Moreover, the mean numbers of relative clause errors per hundred words show an increase with advancing grade level, which, though statistically nonsignificant, is nearly proportional to the increase in the number of relative clauses attempted.

Many of the relative clause errors made by deaf writers revolved around the use of the relative pronoun. In a number of cases where the relative pronoun is obligatory, deaf subjects either failed to generate the necessary NP or else improperly deleted it, e.g., He ran back and got something can hurt the man's leg and The ant held the thing look like circle. Because a relative clause must contain an NP that is virtually identical to the NP left sister of the relative clause and because the identical NP in the relative is moved to the front of the clause, the results are in many instances two identical NP's adjacent to one another. These two NP's, however, do not appear alike in a well formed surface structure as the NP in the embedded sentence is changed to a relative pronoun by a WH-transformation. Apparently, though some deaf writers lacking the WH rule simply omitted one of the two identical NP's and allowed the remaining NP to function as a constituent in both the matrix and the embedded sentence. For example, in the sentence *The ant held the think look like circle*, *the thing* is both direct object of the matrix sentence and subject of the embedded sentence.

Other deaf writers who had not yet correctly internalized the WH rule simply added the relative pronoun to the embedded sentence instead of substituting it for the NP which was identical to the NP left sister of the clause. This insertion of the relative pronoun without fronting and deleting the identical NP resulted in a redundant NP in the embedded sentence, e.g., *There was a little hole underground which a smart ant lived in it*.

A third problem related to relative clause transformations which troubled a number of deaf writers was uncertainty as to when relative clauses could be reduced to a word or phrase which could in turn be preposed before the noun in the matrix, i.e., the process whereby *the ball which was red* becomes *the red ball*. Some deaf subjects apparently applied rules analogous to those used to produce pernominal adjectives to create constructions such as *the hunter man* from *the man who was a hunter* or *a rifle gun* from *a gun which was a rifle*.

The findings from the analysis of relative clause errors present a developmental picture similar to that revealed by the findings on nominalization errors. The infrequency of relative clauses, both deviant and well formed, at all grade levels implies that the deaf child begins acquiring the relativization rules rather late in the developmental process. Furthermore, the fact that the number of relative errors per number of relatives attempted remains almost constant from grade three to grade nine and that even in the writing of ninth graders well formed relatives are infrequent suggests that if the congenitally deaf child ever gains command over the battery of relativization transformations, such command is acquired but slowly and with great difficulty.

The findings in this study which suggest that the congenitally deaf child comes to the acquisition of nominalization and relativization transformations comparatively late in the language development process are consonant with findings on the language development of hearing children. Menyuk,(1963b, pp. 414-418) reports that significantly more nursery school children than first graders performed only the first step of multistep transformations such as the transformations producing relative clauses and prenominal adjectives. This inability to control a battery of sequential transformations appears to be common to both hearing and deaf children, at a certain stage in their language development. Further evidence that hearing children gain competence and confidence in the handling of nominalizations and relatives more slowly than in the production of coordinate structures is revealed in the findings of O'Donnell et al. (1967, p. 56). These authors found that whereas the number of nominalizations and relatives written by hearing elementary children increased steadily with age between third and seventh grade, the coordinate structures increased in frequency up to grade five and then decreased from grade five to grade seven, findings which suggest that the rules for coordinating structures were acquired early and used frequently but that skill in the use of other types of transformations was acquired more slowly.

In addition to the three types of transformations already discussed--coordinations, nominalizations, and relatives--other types of transformations were attempted by deaf writers resulting in other types of transformational errors. Although the majority of these were too idiosyncratic to permit generalization, two other types of transformations occurred with sufficient frequency to merit discussion. The more frequent of these two was the complement transformation involved in producing such constructions as I caught him stealing apples. The most frequent error made by the deaf writers in producing these complement constructions was the same error observed in their prouction of nominalizations--the failure to use the correct nonfinite form of the verb. Many deaf subjects incorrectly left the verb in the embedded sentence in the finite form, producing such structures as He heard *it says "Help! Help!"* and *The ant saw the hunter walked along*.

The other transformational error which occurred repeatedly in the writing of deaf students resulted from the students' abortive attempts to express a causative relationship. Two sequences of events in the film were causally related: (1) The dove dropped a leaf and the leaf fell to the pond. And (2) the hunter shot some apples and the apples fell to the ground. Some deaf writers tried valiantly, though unsuccessfully, to embed one sentence into another so as to express this relationship, thereby producing such anomalies as, *He shoot several the apples fell down*, *The man gun to fall apple from tree*, *The bird took a leaf fall in the water*, and *The dove let the leaf felled down*. These unsuccessful attempts to express causative relationships illustrate the plight of the deaf child whose language skills are unequal to express the relationships he is able to conceptualize.

Morphological Errors

Of the eight major types of errors investigated, morphological errors reveal the clearest, most uncomplicated developmental curve in terms of reduced frequency of errors with advancing grade level. The mean numbers of morphological errors decline steadily from grade three through grade nine (see Table 8 and Figure 6). Moreover, a one-way analysis of variance shows the variance attributable to differences between grade means to be significant at the .05 level. Not only does the total number of morphological errors decrease significantly from grade three to grade nine, but also the frequency of two of the three subcategories of morphological errors--errors in verb inflections and in singular-plural inflections--declines significantly between grades three and nine (see Table 8 and Figure 6).

Most of the verb inflection errors fall into one of three subtypes--verb inflection omitted, regular verb inflection overgeneralized, and tense shift. The most frequently committed error of the three was omitting the verb inflection, e.g., *So she fly and get a leaf*. Such errors were most common in the writing of the youngest subjects, with the mean number of verb inflection omissions declining steadily from grade three through grade nine (see Table 9). This decline was found to be significant at the .05 level by a one-way analysis of variance.

Errors classified as over-generalized verb inflections refer to the use of a regular ending such as the *-ed* allomorph of the past tense morpheme with a verb which must be inflected according to a less general rule such as *to fly*, e.g., *The dove was scared and flied away*. Sometimes the deaf writer indicated his recognition that a particular verb did not inflect according to the general rule by first applying some rule changing the internal

TABLE 8.--Mean Numbers of Various Types of Morphological Errors per Hundred Words

Type of Error	Grade 3 Mean	Grade 3 SD	Grade 5 Mean	Grade 5 SD	Grade 7 Mean	Grade 7 SD	Grade 9 Mean	Grade 9 SD
Verb Inflection Error	6.70	4.78	5.51	4.94	5.46	5.32	3.55	3.30
Singular-Plural Errors	1.92	1.98	1.24	1.93	.89	1.48	.94	1.01
Possessive Errors	.18	.59	.18	.55	.03	.13	.01	.08
Total Morphological Errors	9.52	5.59	7.58	6.67	6.56	6.12	4.75	3.71

TABLE 9.--Mean Numbers of Various Types of Verb Inflection Errors per Hundred Words

Type of Error	Grade 3 Mean	Grade 3 SD	Grade 5 Mean	Grade 5 SD	Grade 7 Mean	Grade 7 SD	Grade 9 Mean	Grade 9 SD
Verb Inflection Omissions	5.52	4.33	4.45	4.46	4.34	4.99	2.68	2.82
Verb Inflections Overgenerlized	.24	.70	.10	.20	.06	.18	.25	.58
Tense Shift	.72	1.08	.67	.94	.70	.85	.33	.52
Total Verb Inflection Errors	6.70	4.78	5.51	4.94	5.46	5.32	3.55	3.30

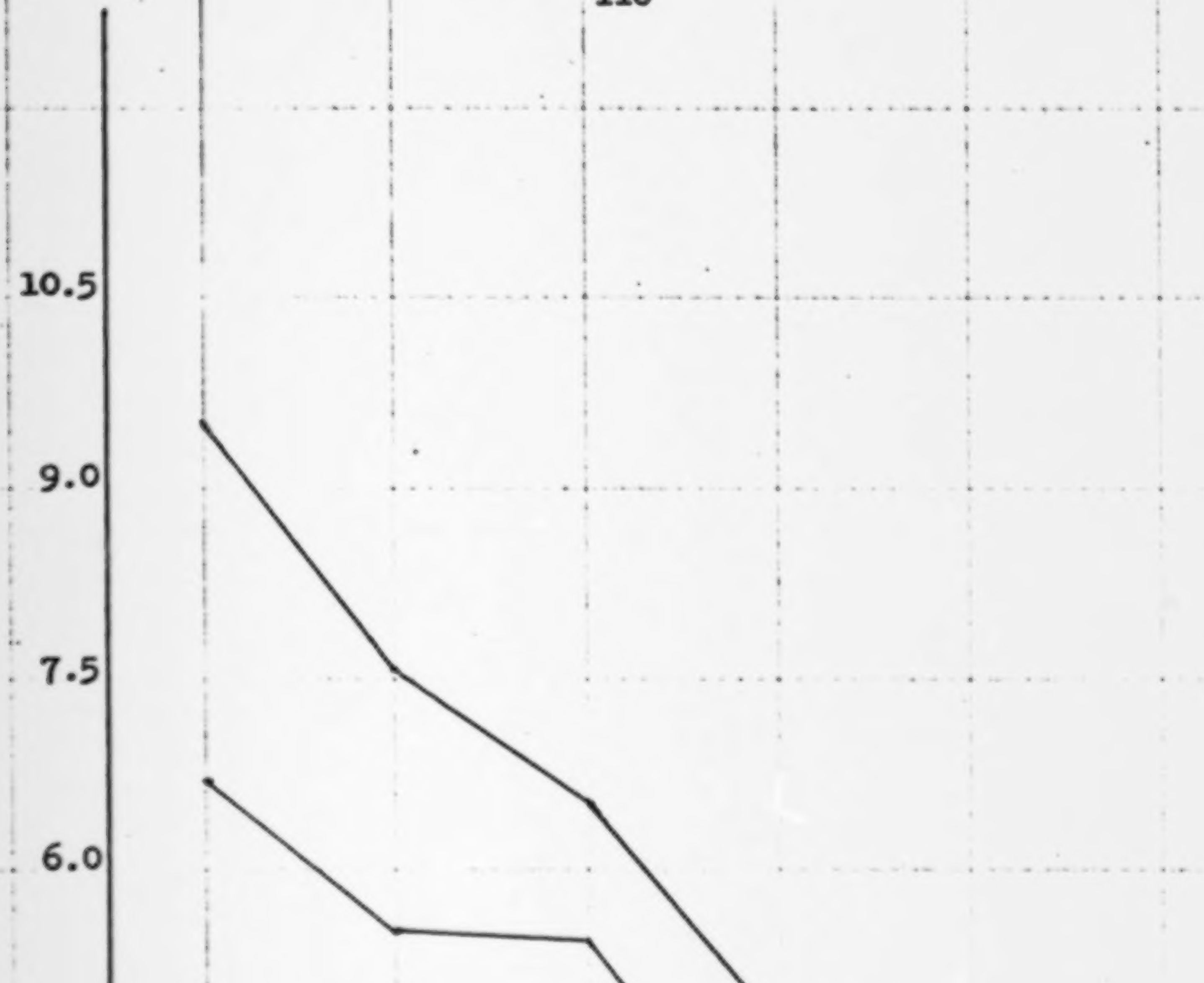

FIGURE 6.--Mean Numbers of Various Types of Morphological Errors per Hundred Words

vowel and then adding the regular allomorph to the already ablauted form, e.g., The circle broked. In the data analyzed, eleven verbs were frequently used with overgeneralized inflections: put, break, fall, shoot, bite, hurt, catch, sleep, fly, hit, and hear. However, no developmental trends were revealed from the mean numbers of such errors across grade levels, and a one-way analysis of variance showed the variance attributable to the difference between grade means to be nonsignificant.

Tense shift errors included unacceptable shifts from past tense to present or vice versa, particularly those shifts which occurred within a single T-unit, e.g., Dove saw ant can't swim. Such errors occurred only slightly more frequently than overgeneralized verb forms (see Table 9) and although the mean numbers of tense shift errors declined from grade three to grade nine, a one-way analysis of variance showed this decline to be nonsignificant.

The bulk of singular-plural inflection errors were of one of the following types: the omission of the plural inflection, the redundant use of the plural inflection, and the use of an incorrect morphographemic form of the noun stem, e.g., the use of leave as a singular allomorph. Somewhat surprisingly, the most frequently occurring of these errors was the redundant use of the plural morpheme, the other two types of errors occurring with about equal frequency (see Table 10). However, although the mean total number of singular-plural errors did decline significantly with advancing grade levels, none of the three subtypes of singular plural errors revealed an equally clear developmental trend. Only the mean numbers of morphographemic stem errors declined steadily from grade three to grade nine, and this decline was statistically nonsignificant.

Other types of morphological errors observed in the writing of deaf subjects included errors in the use of the possessive morpheme, errors in pronoun person, number, case and gender, and confusion over the use of the allomorphs a and an. Although the mean frequency of many of these errors generally declined with advancing grade level, none was found to vary significantly across grade levels.

The findings from the analysis of morphological errors suggest a number of things about the order in which the congenitally deaf child acquires the rules of his language. First the fact that a number of papers written by deaf students in the lower grades contained virtually no inflectional endings suggests that the morphological rules of a language are not among the earliest rules acquired by the congenitally deaf child. Indeed, the implication is that the deaf language learner passes through a phase in his language development during which the only rules he has internalized generate categories in

TABLE 10.--Mean Numbers of Various Types of Singular-Plural Inflection Errors per Hundred Words

Type of Error	Grade 3		Grade 5		Grade 7		Grade 9	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Plural Inflection Omitted	.42	.69	.25	.52	.30	.48	.25	.50
Plural Inflection Redundant	1.12	1.99	.54	1.87	.28	.80	.48	.73
Wrong Stem Allomorph	.41	.91	.40	.80	.28	.50	.22	.51
Total	1.92	1.98	1.24	1.93	.89	1.48	.94	1.01

a certain order, categories which are realized in the surface structure as uninflected lexical items. During this stage of his language development the deaf child acquiring language appears to have few, if any, morphological rules in his repertoire. Moreover, the fact that the deaf child should pass through such a stage is hardly surprising since a similar stage has been observed in the language acquisition of hearing children (Brown and Bellugi, 1964).

However, the fact that most deaf subjects even in the third grade used some inflections, even though these inflections were not used consistently, implies that the process of acquiring morphological rules begins for most deaf children at least as early as and probably earlier than the lowest developmental stage sampled in this study.

Thus, from the findings of this research it appears that most congenitally deaf children begin to acquire certain rudimentary morphological rules earlier than they begin to acquire the transformation rules involved in producing nominalizations and relatives.

The presence of overgeneralized verb inflections in the writing of the deaf suggests that the order in which the morphological rules are acquired is from most general to most idiosyncratic. That is, the more general rules are acquired earliest and overspread to circumstance where they do not apply, and the least general rules and exceptions are acquired last. These findings on the deaf child's acquisition of morphological rules are quite consonant with those of earlier studies on the development of morphological rules in hearing children (Berko, 1958), and deaf children (Cooper, 1965).

However, although the process of acquiring morphological rules appears to be already underway for most deaf students by the time they reach the third grade, the findings of this study indicate that many students still have not mastered these rules by the time they reach the ninth grade. The mean number of morphological errors for ninth graders per hundred words accounts for 27% of the mean total number of errors. Nevertheless, significant progress in acquiring these rules appears to be made between grade three and grade nine as the mean number of morphological errors declines steadily and significantly during this time span. Because the process of acquiring morphological rules spans the entire range of development sampled in this study, the number of morphological errors per hundred words is a better index of language development than any of the other error ratios.

Order Errors

Errors in the ordering of categories occurred relatively infrequently in the writing of the deaf subjects, especially in the upper three grades (see Table 4). Moreover, in the third grade, where the frequency of order errors was nearly four times as great as at any other grade level, the grade mean was greatly inflated by the performance of two students whose writing was exceptionally deviant, a fact reflected in the large standard deviation for this variable in the third grade (see Table 4). As the mean number of order errors is almost constant from grade five to grade nine, and as the within group variance for grade three is so great, a one-way analysis of variance shows the variance attributable to the differences between grade means to be nonsignificant.

Although acquiring rules which output categories in the proper order in the surface structure is clearly an essential part of learning a language and probably occurs very early in the language acquisition process, the findings of this study produce but meager evidence on which to base generalizations about this particular aspect of language learning. Some evidence that learning to order elements correctly occurs extremely early in the deaf child's language acquisition process is provided by the fact that the few deaf subjects whose writing contained repeated order errors were in the lower grades and by the fact that these subjects also made so many other errors that their ratios of total errors per hundred words were among the highest individual error scores in the sample. As a result of this high frequency of errors, the bulk of the writing by these students verged on being uninterpretable, and indeed extensive passages had to be excluded from the analysis on the grounds of uninterpretability.

The fact that passages in which order errors occur asymptotically approach uninterpretability, partly because the order errors themselves result in such deviant constructions and partly because order errors tend to co-occur with numerous other errors, presented a serious obstable to the analysis of such errors. The observed low frequency of such errors may have been partially due to the analysts' exclusion of passages containing order errors as uninterpretable.

Another problem encountered in analyzing order errors was the fact that such errors are highly idiosyncratic. Although three subcategories of order errors were set up in advance of the analysis--subject-verb reversals, verb-object reversals, and adjective-noun reversals--the great majority of order errors actually observed had to be classified as "other," e.g., *Then it put back the cookie together*, *by good* (for good-bye), *He found other his ball*, and *The ant fell deep to the water*. There were only three verb-object reversals and four adjective-noun reversals in the writing of all four grades combined. There were only slightly more subject-verb reversals, twelve in all four grades combined, and most of these were produced by the two third graders mentioned earlier.

Because of the difficulties encountered in analyzing order errors, difficulties resulting from the infrequency and idiosyncracy of such errors and from the uninterpretability of passages containing such errors, any inferences made on the basis of the findings from this study must be viewed as highly tentative. However, from the slim evidence available it appears that the correct ordering of elements is learned quite early by the deaf child. Such an inference is in line with findings on the language acquisition of hearing children. Brown and Bellugi (1964), who observed two hearing children in the process of acquiring language, report that even in the most primitive stages of their language development, stages when inflections and function words were not a part of their language repertoire, these children still retained the same ordering of major categories in their utterances as would be used by an adult native speaker.

Selectional Errors and Other Errors

Selectional errors and other errors are treated together in this discussion because a major problem was encountered in the analysis in deciding whether a given error in word choice was a selectional error involving incompatibility of syntactic features or some other kind of semantic or stylistic error. Part of this problem stemmed from the lack of a theory specifying what all the syntactic features are. Although fragmentary lists of such features appear in Aspects of the Theory of Syntax (Chomsky, 1965) and elsewhere, most of the unacceptable word combinations produced by the deaf writers could not be described in terms of [± common], [± count], [± plural], [± abstract], [± animate], or [± human], the most commonly listed syntactic features.

A few word choice errors, though, could be analyzed in terms of the features listed above, and these were classified as selectional errors. The most common selectional errors encountered were combinations of determiners and nouns which were mutually incompatible with respect to the feature [± count] e.g., a water and the few grass, or with respect to the feature [± plural], e.g., a scissors and a pliers. Other types of selectional errors occurred so infrequently as to make generalizing impossible. Indeed, the mean frequency of selectional errors is less than one such error per three hundred words. Moreover, the mean number of such errors reveals no developmental trend across grade levels, and an analysis of variance finds no significant difference between these means.

On the other hand, those word choice errors classified as other errors occurred much more frequently than selectional errors at every grade level. Moreover, the mean number of other errors declined from grade three to grade nine, with the sharpest decline occurring between grades three and five (see Table 4). A one-way analysis of variance shows the variance attributable to differences between grade means to be significant at the .05 level, and the Duncan Multiple Range Test indicates a significant decline between grades three and five.

To generalize about those word choice errors classified as other errors is virtually impossible. Some appeared to result from incompatible semantic features, some from incompatibility between the word chosen and the events that transpired in the film, and some from the students' unfamiliarity with English idioms. The following examples of other word choice errors illustrate the variety of such errors:

The ant go $\overset{\text{Other}}{\underline{\text{to bedtime}}}$ (for The ant went $\underline{\text{to bed}}$), . . . he was $\overset{\text{Other}}{\underline{\text{free}}}$ and floated on the water (for . . . he was $\underline{\text{safe}}$. . .), $\overset{\text{Other}}{\underline{\text{At}}}$ the afternoon . . . (for $\underline{\text{In the}}$ afternoon), The ant pushed the ball into his $\overset{\text{Other}}{\underline{\text{roommate}}}$ (for . . . into his $\underline{\text{bedroom}}$), He sheet 8 times $\overset{\text{Other}}{\underline{\text{to}}}$ the apple tree (for He shot 8 times $\underline{\text{at}}$ the apple tree), Ant saw a $\overset{\text{Other}}{\underline{\text{father}}}$ (for The ant saw a $\underline{\text{man}}$).

Both types of word choice errors, those classified as selectional and those classified as other, appear to stem from the deaf child's lack of vocabulary control. Either the deaf child's vocabulary does not include certain lexical items and he is forced to make inappropriate substitutions, or else he has in his vocabulary items for which he has incorrect or incomplete definitions. However, when the mean numbers of selectional and other errors are viewed together, a developmental picture emerges of increasing vocabulary control with advancing grade level. Moreover, this growth of vocabulary control apparently spans the entire developmental range surveyed, and findings from the error analysis of the hearing group in this study suggest that it is still going on at even more advanced stages of language development.

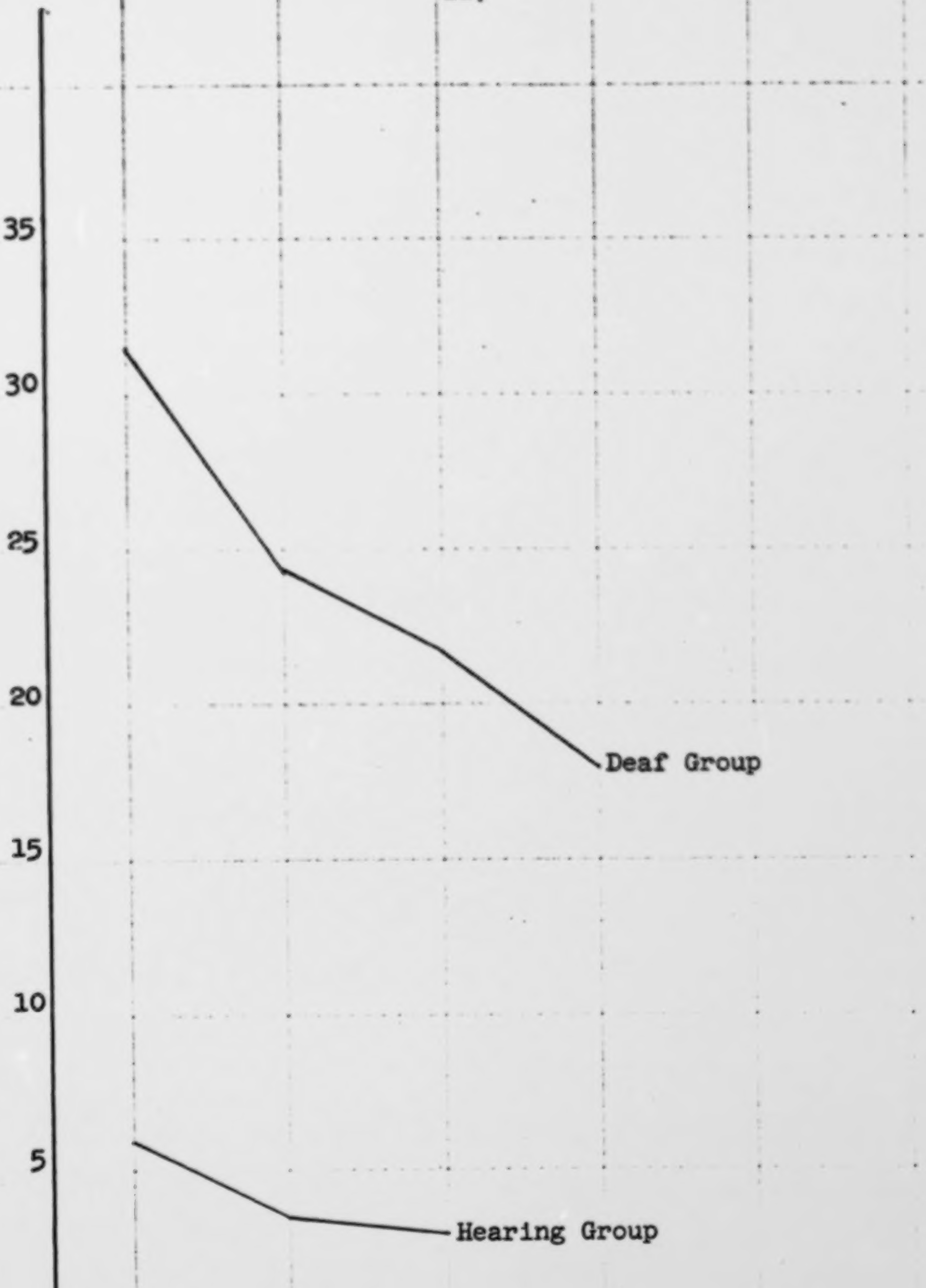

FIGURE 7.--Mean Numbers of Errors per Hundred Words

Findings from the Error Analysis of the Hearing Group

The findings from the error analysis of the hearing data indicate that for hearing children the process of reducing grammatical errors by bringing the rules of their grammars into conformity with those of the adult model is nearly completed by the time they reach the third grade, the earliest developmental stage sampled in this study. The mean number of total errors for hearing third graders was 5.93, or approximately a third the mean for deaf ninth graders, 17.92. However, the fact that hearing children still make further progress in reducing grammatical errors after grade three is indicated by the fact that the mean number of total errors per hundred words made by hearing children declines sharply between grades three and five, and then less sharply between grades five seven. The variance attributable to differences between these grade means is significant at the .05 level, and a significant decline was found to occur between grades three and five.

Although the mean numbers of total errors made by hearing children suggests a clear developmental trend, the breakdown of these errors into subclasses results in such low frequencies of errors that few observations about the hearing child's acquisition of rules can be made on the basis of these data. In only three subclasses--

morphological errors, verb inflection errors, and other word choice errors--does the error being studied occur as often as once in a hundred words. Thus even those findings which suggest a developmental trend must be viewed with some skepticism since with such low frequencies of errors the grade means might easily be inflated by the performance of a few students. Since so many of the findings from the analysis of errors in terms of subclasses for the hearing group are unrevealing, all grade means and standard deviations from this analysis are reported in Appendix C, and only those which show significant differences or at least a steady decline with advancing grade level will be discussed.

Only two subclasses of errors showed differences among grade means significant at the .05 level--nominalization errors and other word choice errors. Both of these variables declined with advancing grade level and significant differences were found between grades three and five in the case of nominalization errors and between grades three and seven in the case of other word choice errors. These findings on nominalization errors are harmonious with the findings on nominalization errors in the writing of the congenitally deaf in that both sets of findings suggest that the full complement of transformational rules involved in producing nominalizations is acquired late in the language development process.

The finding on the other word choice errors present a developmental picture which fits well with the developmental pattern suggested by the findings on this variable in the writing of deaf children. The total picture suggested by both sets of findings is that the child begins to use words with ever greater precision even in the early stages of his language development and that he gains increasing command in the area of word choice as long as he is adding words to his lexicon.

Other variables for the hearing group which show a decline in grade means with advancing grade level are strict subcategorial errors, direct object omissions, preposition omissions, major categorial errors, transformational errors, morphological errors, verb inflection errors, and verb inflection omissions. In each of these variables a marked decline occurs between grades three and five, with practically no change occurring in the means between grades five and seven.

Although in most cases the structures resulting from the violation of a particular type rule were similar for deaf and hearing writers, in one subclass listed above, strict subcategorial errors, this was not the case. Twenty per cent of all strict subcategorial errors made by hearing subjects appeared to be the careless errors which occur in writing when the writer's head and hand get out of phase, e.g., *He rode on the snail*$\overset{\text{SCat}}{\text{'s}}$ *snail's back* or $\overset{\text{SCat}}{\text{The}}$ *walked* down the path. On the other hand only one strict subcategorial error made by a deaf subject appeared to be of this nature. Thus the mean number of strict subcategorial errors for the hearing groups is not really comparable to the mean for deaf children. Moreover, the decline in the mean number of strict subcategorial errors for hearing children may not reflect the acquisition of the same skills that this decline reflects for the congenitally deaf.

The major implication of the findings from the error analysis of hearing children's writing is that the process of error reduction, or viewed the other way round the process of rule acquisition and rule modification, occurs at a rapid rate in the early stages of language acquisition and then decelerates in the later stages as the writer approaches the asymptote of error-free performance. This decelerating rate of error reduction is illustrated graphically in Figure 7, where the steepest slope in the curve of the mean total number of errors occurs between the means for third and fifth grade deaf writers. From there the curve gradually levels out as it approaches the asymptote, with the least steep slope occurring between the means for fifth and seventh grade hearing writers.

Summary

1. The findings from the error analysis produce some evidence which suggests that deaf children do produce utterances by means of internalized rules and that in the early stages of language acquisition these rules are continually being brought into closer conformity with those of the adult model. The evidence for the existence of internalized rules is the repeated and predictable occurrence of particular deviant constructions in the writing of a single child. The primary evidence that these rules are gradually being brought into conformity with those of the adult model is the decreasing frequency of errors with advancing grade level.

2. The findings from the analysis of strict subcategorial errors suggest that one of the earliest rules acquired by the deaf child is S → NP + VP, where VP obligatorily contains a verb or copula. Evidence for this inference is the fact that almost no subjects were omitted by deaf writers at any grade level and the infrequent omissions of verbs and copulas occurred almost exclusively in the writing of the youngest writers. The analysis of preposition omissions revealed the greatest number of such errors occurring in the writing of third graders, the frequency thereof declining with advancing grade level. This finding implies that many deaf children acquire the rule VP → V (NP)(NP) before they acquire rules introducing

prepositions. Moreover, the mean numbers of redundant prepositions at grades five, seven and nine suggest a developmental pattern in which the students first acquire the rules needed to generate prepositions and then overspread these rules to situations where they do not apply. However, the comparatively large number of such redundancies in the writing of third graders is inconsistent with this pattern. Finally, no clear developmental trends emerge from the analysis of direct object omissions; however, such omissions appeared to be interrelated with three other aspects of language development.

3. The findings from the analysis of major categorial errors reveal that such errors are infrequent at all grade levels, that the frequency of such errors is not closely related to other aspects of language development or to advancing grade level, and that constructions resulting from such errors are not nearly so deviant as would have been predicted on the basis of the theory of grammatical deviance presented in Aspects of the Theory of Syntax (Chomsky, 1965, pp. 148-153).

4. The findings from the analysis of minor categorial errors indicate that the deaf child gains command over the use of determiners and auxiliaries only slowly and with great difficulty. Such errors were frequent at all grade levels, and although the mean numbers of minor

categorial errors declined from grade three to grade nine, the relatively large mean for the ninth grade suggests that many deaf ninth graders still had not acquired all the rules necessary to use these minor categories correctly. The deaf child's extreme difficulty in gaining control over the use of determiners and auxiliaries appears to be one respect in which his language acquisition process differs from that of the hearing youngster.

5. The findings from the analysis of transformational errors reveal that such errors occurred infrequently in the writing of deaf third graders, increased markedly between grades three and five, declined slightly from grade five to grade seven, and then leveled off on a kind of plateau from grade seven to grade nine. The infrequency of both transformational errors and embedded structures attempted at the third grade level implies that rules related to embedding sentences are not acquired in the earliest stages of language development. However, the fact the number of embeddings increased significantly from grade three to grade nine, while the number of transformational errors increased insignificantly from grade three to grade five and then declined or remained constant thereafter suggests that once he has begun embedding structures the deaf child makes measurable progress in mastering the various transformational rules involved.

Of the various types of sentence embedding transformation, the rules involved in coordinating constituents appear to be acquired earliest by the deaf child. The mean number of conjoining errors made by deaf writers peaked in grade five and declined thereafter while the number of coordinate structures attempted increased significantly during the same time span. On the other hand the deaf child's mastery of the transformational rules involved in producing nominalizations and relatives comes much later, if at all, as indicated by the increasing frequency of nominalization and relative errors from grade three to grade nine and the concomitant infrequency of such structures attempted.

6. Order errors were found to be particularly difficult to analyze because of the infrequency and idiosyncrasy of such errors and because of the uninterpretability of passages containing such errors. However, the findings reveal that order errors occurred almost exclusively in the writing of the most immature writers, suggesting that learning the correct ordering of constituents occurs early in the language acquisition process.

7. Selectional errors and other errors were both found to involve errors in word choice. Moreover, because a complete list of syntactic features has yet to be formulated, it was often difficult to decide whether a particular error was a selectional error or some other type of word choice error. However, the combined findings of the

analyses of both types of word choice errors show a declining frequency in such errors with advancing grade level, suggesting that as the deaf child matures, his vocabulary expands and he becomes ever more precise in choice of words.

8. The findings from the error analysis of the writing of hearing children reveal that the mean numbers of total errors for the hearing subjects are much smaller at every grade level than the mean numbers of total errors for the deaf subjects. The mean numbers of total errors made by the hearing students were found to decline significantly from grade three to grade seven; however, this rate of decline was not nearly so great as that for the deaf subjects. The implication of these findings is that the reduction of errors in written language performance continues long after the writer has acquired most of the rules of his language; however, as the writer approaches the asymptote of error-free writing this reduction of errors proceeds at a decelerating rate.

CHAPTER V

FINDINGS FROM THE QUANTITATIVE ANALYSIS

In the quantitative phase of the analysis, the writing of the congenitally deaf subjects was analyzed in terms of the following quantitative measures: mean length of composition, mean number of words excluded as uninterpretable per hundred words written, mean clause length, mean number of clauses per T-unit, mean T-unit length, mean number of T-units per sentence, and mean sentence length. The purpose of this phase of the analysis was twofold: (1) to see what developmental trends emerged in the language performance of the deaf by comparing the means derived from these quantitative measures of their writing at the four grade levels, and (2) to compare the deaf subjects' rate of language development as measured by these quantitative indices with that of hearing children.

Mean Composition Length

The findings on the first variable listed above, mean composition length, reveal the same developmental trend observed in earlier language development studies on both deaf and hearing children. That is that composition length increases with age. The findings from this study show the mean numbers of words per composition increasing steadily with advancing grade level for both the deaf and hearing groups (see Table 11 and Figure 8). Furthermore, the variance attributable to differences between means is significant at the .05 level for both groups, with significant increases occurring between grades three and five for the deaf group and between every grade level for the hearing group.

The findings from this study further show a marked difference in mean composition length between the deaf and the hearing groups, especially in the upper grades. The mean composition length of the hearing fifth graders is approximately thirty words longer than that of deaf fifth graders, and the mean composition length of the hearing seventh graders is approximately 95 words longer than that of deaf seventh graders and 75 words longer than that of deaf ninth graders (see Table 11 and Figure 8). However, Heider and Heider (1940), who also compared the written compositions of deaf and hearing groups, found differences between the mean composition lengths of deaf and hearing writers to be "unimportant" (p. 100). These authors report:

> The difference between deaf and hearing in this comparison is not great. According to absolute age, for the four parallel age groups, the compositions of the deaf are shorter, but if we compare the youngest deaf [eleven year olds] with the youngest hearing children [eight year olds] (and so more nearly equalize language experience), we find that the compositions

TABLE 11.--Mean Composition Length

Grade	3		5		7		9	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Deaf	102.97	36.48	148.09	67.20	165.57	64.43	184.23	71.80
Hearing	111.53	47.90	180.20	57.59	259.13	150.49		

TABLE 12.--Number of Words Excluded per Hundred Words Written

Grade	3		5		7		9	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Deaf	6.55	8.74	4.14	7.15	5.22	9.50	6.49	8.64
Hearing	.20	1.11	.00	.00	.24	1.12		

> of the deaf are longer. The curve continues to rise in the higher age groups of the deaf and the final average for the seven years is higher for deaf than for hearing. But this difference is not great enough to be considered important in the absence of a more definite basis for comparison (1940, pp. 52-53).

However, in the present study, although the mean age of the deaf writers at every grade level is two years greater than that of the hearing writers in the same grade, the mean composition length of the hearing students still exceeds that of the deaf students by the sizable margins cited above. Since neither the Heiders' study nor the present study makes any statistical comparisons between the mean composition length of the deaf and hearing groups, the question of whether the observed differences are significant

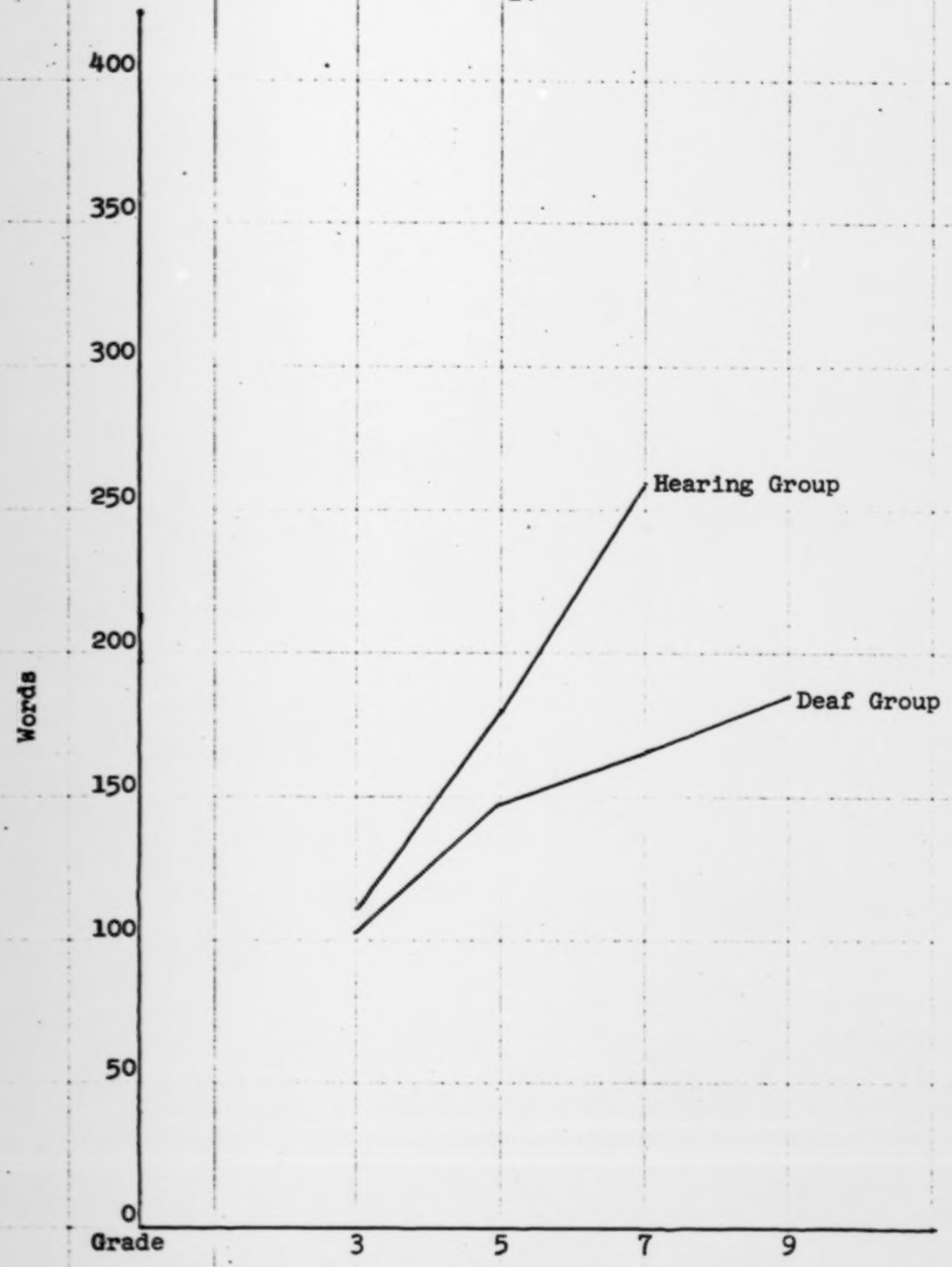

FIGURE 8.--Mean Composition Length

cannot at the present be resolved. However, the size of the observed difference between the two groups found in the present study suggests that it would be premature at this point to dismiss such differences as "unimportant."

Mean Number of Words Excluded

Findings on the number of words excluded as uninterpretable per hundred words written reveal no clear developmental trend when the means for either the deaf or hearing group are compared across grade levels. For the deaf group the mean number of words excluded is greatest at the third grade level and lowest at the fifth grade level; then between grades five and nine the mean number of words excluded increases steadily till the ninth grade mean is nearly equal to the third grade mean (see Table 12 and Figure 9). A one-way analysis of variance shows the differences between these means to be statistically nonsignificant.

Although the mean number of words excluded as uninterpretable per hundred words might be expected to decrease with advancing grade level, a number of factors besides grade level must be considered when viewing these means, factors which tend to explain why the curve presented by the means themselves ostensibly shows no relationship between this variable and advancing grade level. The first such factor is the large standard deviation found at every grade level. So much variance within grades suggests

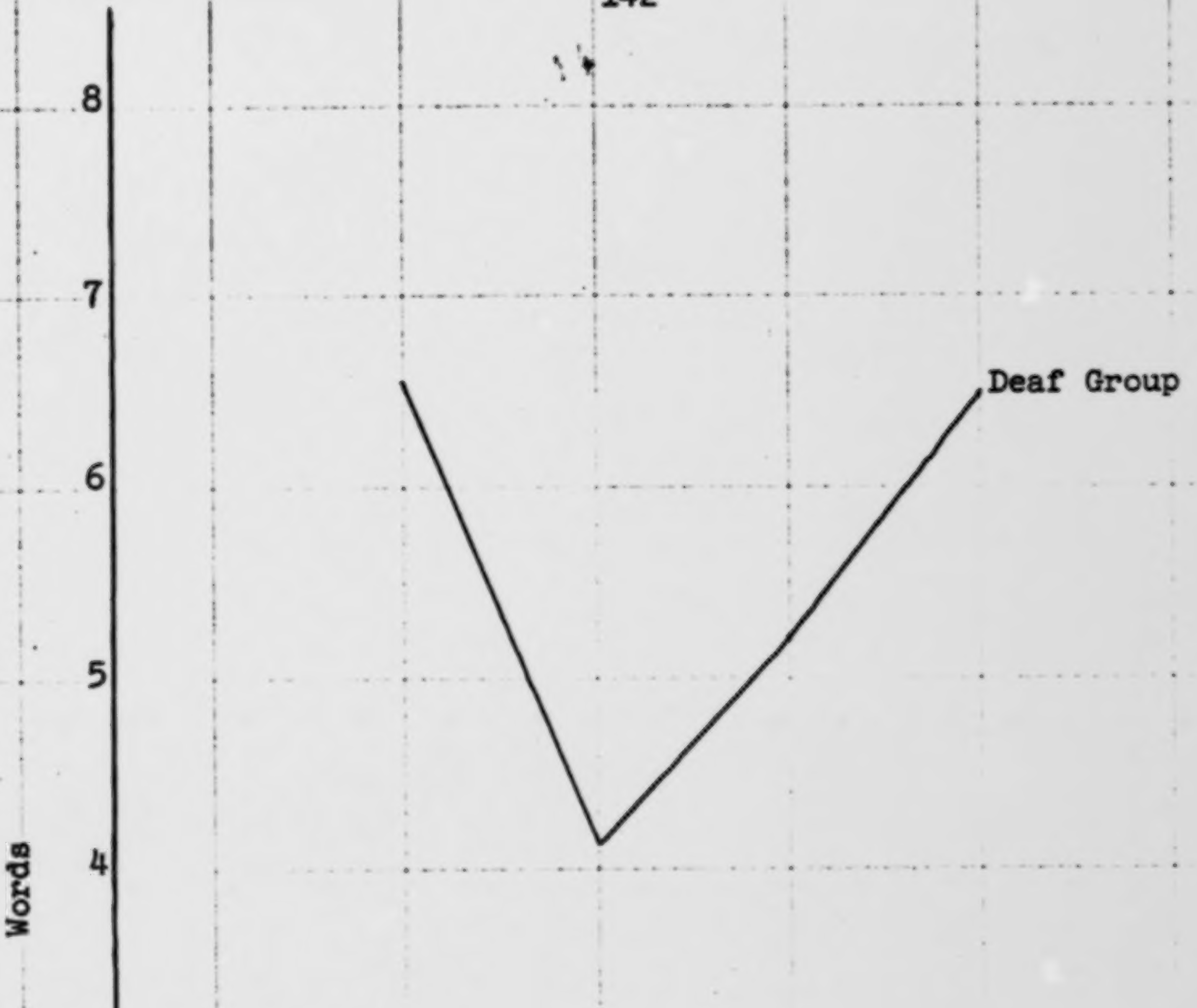

FIGURE 9.--Mean Number of Words Excluded per Hundred Words Written

that the means may be greatly inflated by extensive excluded passages in the performance of a few writers. This seems especially likely since the size of the means, the size of the standard deviations, and the lower limit of zero all indicate a skewed distribution at every grade level.

A second factor to be considered is the fact that the older writers were attempting more complicated constructions, constructions which if malformed may have been more difficult to interpret than the simpler constructions of the younger writers. Furthermore, as uninterpretable passages had to be excluded so as not to leave fragmentary T-units in the corpus retained for analysis, the fact that the older students wrote longer clauses and T-units resulted in longer passages being excluded from their writing in order to extirpate the uninterpretable gobbets.

One final factor which may have affected the findings for this variable somewhat was the order in which the error analysis was carried out. Since the analysts began with the ninth grade papers and proceeded through the grades in descending order, it is possible that through the process of working together the analysts gradually synchronized their biases on how to interpret certain deviant structures, so that a borderline passage excluded in a ninth grade paper might have been retained for analysis had it occurred in a fifth grade paper.

Although the mean numbers of words excluded presents no clear developmental picture across grade levels, there is a striking difference between these means for the hearing and the deaf groups (see Table 12 and Figure 9). The insignificant mean numbers of words excluded for the hearing group--the means for the hearing group were roughly $\frac{1}{40}$ the size of the means for the deaf group--suggest that for a hearing child to write a sentence so deviant as to be counted uninterpretable was an exceedingly rare occurrence. Those passages excluded as uninterpretable in the error analysis of this study were not equivalent to the garbles and mazes of earlier studies (Hunt, 1965), (O'Donnell et al., 1967), as some of the constructions classified as garbles or mazes in those studies might have been analyzed in this one. Thus the findings on the mean number of words excluded as uninterpretable in the present study and the mean length and frequency of garbles in the earlier studies are not strictly comparable. Nevertheless, when Hunt's findings (1965, p. 7) on garbles in the writing of hearing children are converted to number of words excluded per hundred words written, the means--.45 for fourth graders, .04 for eighth graders, and .07 for twelfth graders--are roughly similar to the means for the hearing group in the present study, suggesting that even garbles, which may be less deviant than the uninterpretable passages in the present study, are rare in the writing of hearing children.

Mean Clause Length

The findings of this study show mean clause length to increase steadily with advancing grade level (see Tables 13 and 14 and Figure 10). Although absolute gains in mean clause length are not great from one grade to the next, the variance within groups is quite homogeneous, and one-way analyses of variance show the variance attributable to the difference between means to be significant at .05 level for both groups. Furthermore, subsequent Duncan Multiple Range tests reveal a significant increase in mean clause length between grades five and seven for the deaf group and between grades three and five for the hearing group.

As in the case of mean composition length and mean number of words excluded, the findings on mean clause length show the hearing writers to be ahead of the deaf writers at every grade level, ahead in the sense that the hearing writers are performing at a level which will only be attained by their deaf peers two or four years hence. For example, the hearing third graders in this study wrote clauses which were on the average as long as or longer than the clauses written by the deaf seventh graders. However, although the mean clause length of the hearing students exceeds that of the deaf at every grade level, the rate of growth as measured by gain in clause length from grade to grade appears to be roughly the same for both

TABLE 13.--Synopsis Scores for the Deaf

Grade	Words/Clause		Clause/T-unit		Words/T-unit		T-units/Sentence		Words/Sentence	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
3	5.88	1.05	1.034	.058	6.07	1.09	1.201	.375	7.31	2.76
5	6.44	1.39	1.071	.078	6.89	1.54	1.159	.205	8.12	2.74
7	7.09	1.59	1.188	.222	8.53	2.95	1.317	.282	11.35	4.72
9	7.22	1.28	1.081	.124	7.84	1.88	1.383	.562	11.21	6.30

TABLE 14--Synopsis Scores for the Hearing

Grade	Words/Clause		Clause/T-unit		Words/T-unit		T-units/Sentence		Words/Sentence	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
3	7.10	.99	1.071	.104	7.60	1.35	1.543	.598	11.93	5.53
5	8.24	1.62	1.129	.114	9.24	1.64	2.193	1.957	20.01	17.96
7	8.33	1.02	1.198	.119	9.97	1.53	2.101	3.771	19.39	28.67

groups (see Figure 10). Whereas the mean clause length for hearing writers increases 1.23 words between grades three and seven, the mean clause length for the deaf writers increases 1.21 words over the same interval and increases 1.32 words between grades three and nine. The findings from Hunt's study on hearing children (1965, p. 51) show an increase in clause length of 1.5 words between grades

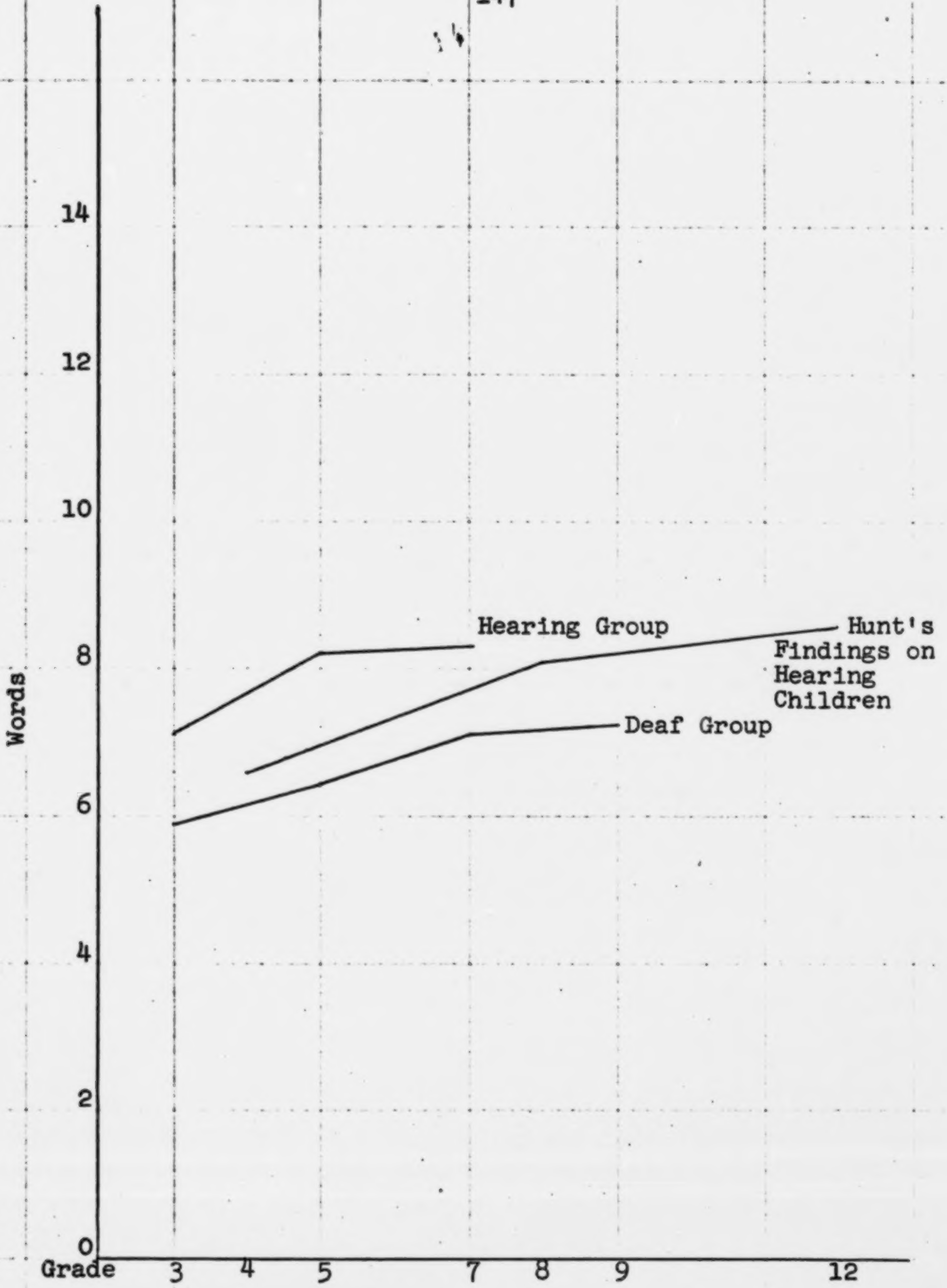

FIGURE 10.--Mean Clause Length

four and eight, indicating a rate of development not too different from that found for deaf and hearing students in the present study.

From the above findings it appears that contrary to the findings of Heider and Heider, deaf students do increase their mean clause length significantly with advancing grade level and at about the same rate of their hearing peers. It would be misleading, however, to assume that this increase is the product of the same type of language development in both groups. In the case of hearing children this increase is probably due almost entirely to the increased number of subclausal embedded structures the older writers employ. In the case of the deaf writers, however, although the increased number of subclausal embeddings at higher grade levels is surely a contributing factor to the increased clause length, an equally important factor is the reduction of various types of omission errors. The findings of the error analysis on the writing of the deaf show a marked reduction in strict subcategorial omissions and determiner omissions with advancing grade level, a reduction that is simultaneous with the increase in clause length. However, as the findings show such omissions to be extremely infrequent in the writing of hearing children at every grade level, with no marked decrease across grade levels, the reduced frequency of such omissions would contribute little to increasing mean clause length.

Mean Number of Clauses per T-unit

Some measures of the frequency of subordinate clauses per main clause has long been recognized to be a reliable indicator of syntactic maturity, and the findings of this study are, in the main, consonant with this generalization. The curve for the mean number of clauses per T-unit for the hearing group in this study rises with advancing grade level, as one would have predicted on the basis of the findings of earlier studies (Hunt, 1965). Moreover, a one-way analysis of variance shows the differences between these means to be significant at the .05 level, and Duncan Multiple Range Tests reveal significant differences between every grade level.

The findings on this variable for the deaf group, however, are not as easily accounted for. Although the mean number of clauses per T-unit shows a general increase

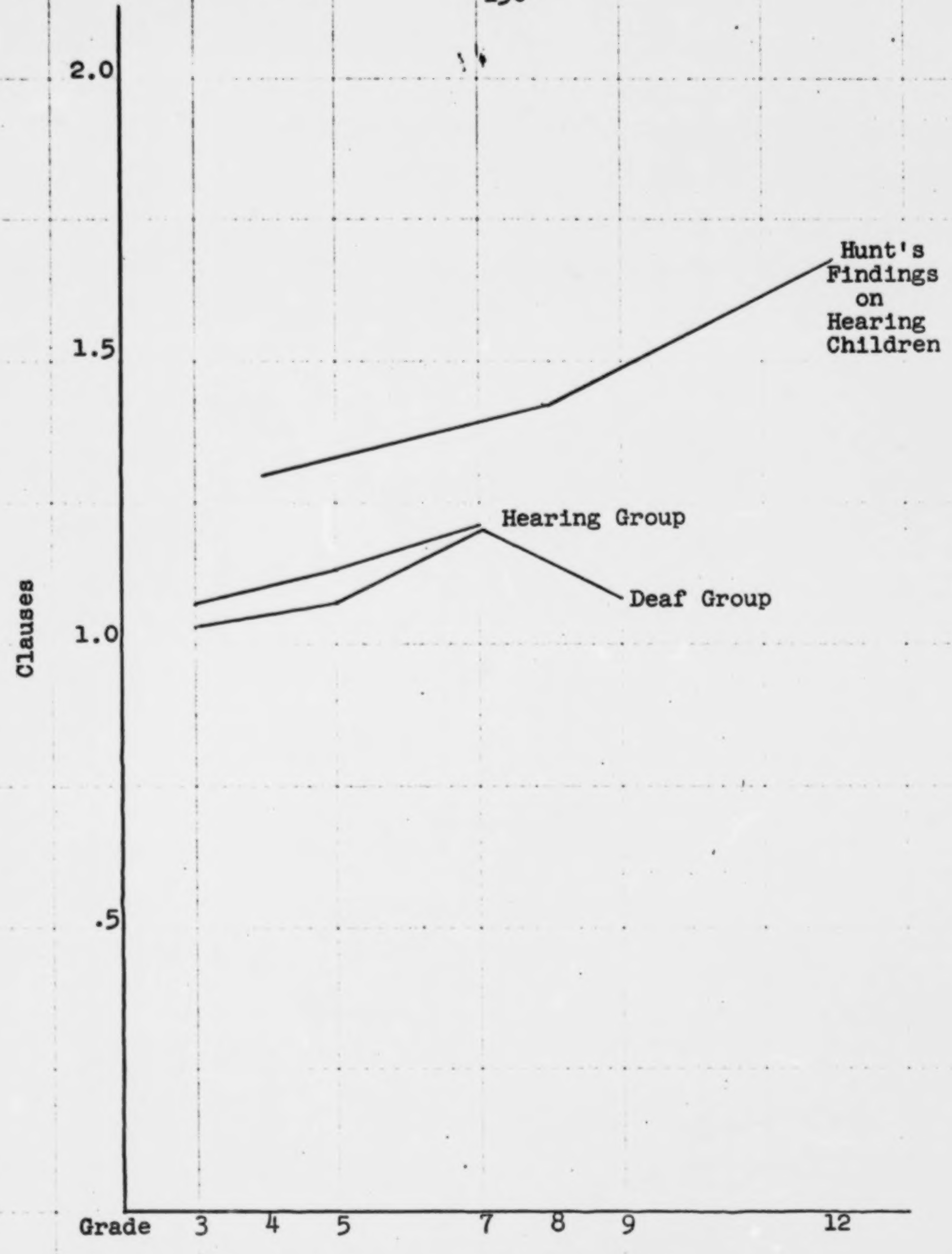

FIGURE 11.--Mean Number of Clauses per T-unit

with advancing grade level, the increase is not a steady one. Instead, there is a modest increase between grades three and five, a dramatic and statistically significant increase between grades five and seven, followed by a statistically significant decrease between grades seven and nine. The curve describing this array of means (see Figure 11) shows the seventh grade mean to be considerably higher and the ninth grade mean to be lower than would have been predicted on the basis of the rate of syntactic development from grade three to grade five.

This peculiar reversal in the developmental curve for deaf students between grade seven and grade nine appears not only in the mean number of clauses per T-unit but also in the findings on all related measures such as T-unit length, sentence length and number of subordinate clauses. Although the author can offer no explanation which fully accounts for this unexpected phenomenon, the following factors are presented as possibly contributing to this apparent enigma. First, the standard deviation for the deaf seventh graders on this variable is extremely large, nearly twice as large as the standard deviation for any other grade, either deaf or hearing, on the same variable. This large variance within the seventh grade deaf suggests that the mean for this group may be inflated by the performance of a handful of particularly able students whose language skills were quite atypical of the grade as a whole.

Secondly, the mean for the ninth grade deaf may be somewhat depressed as a result of the way the sample was drawn. Whereas the deaf sample for grades three through seven included subjects from a private oral school for the deaf where the teacher-pupil ratio was high, expensive equipment was readily available, and admissions could be somewhat selective, the sample for grade nine deaf did not include any subjects with a similar background, as the oral school sampled had no ninth grade. Thus all ninth grades in this study were sampled from state schools for the deaf, schools which must take nearly all applicants and whose financial resources are limited to the funds doled out by the various state legislatures. Moreover, even at these state schools for the deaf, it is possible that the better students, particularly those with the most highly developed language skills, might enter a regular high school program in the ninth grade, thereby lowering the performance level of the ninth grade group remaining in the schools for the deaf.

Since it seems likely that the mean number of clauses per T-unit for the seventh grade deaf is inflated and the mean for the ninth grade deaf is depressed, the best estimate of the developmental curve for this variable could probably be derived by interpolation. However, even without such interpolation, the means on this variable for the deaf confirm the findings of earlier studies that the frequency of subordinate clauses per main clause increases as the writer matures. However, because of the erratic nature of this increase for the deaf group, it is extremely difficult to compare the rate of growth on this variable for deaf and hearing writers on the basis of the findings of this study.

Mean T-Unit Length

Since mean T-unit length is the product of the two previous variables, mean clause length and mean number of clauses per T-unit, the findings on this variable relfect the trends and idiosyncrasies reported above. For both the hearing and the deaf groups there is a general and significant increase in T-unit length with advancing grade level (see Tables 13 and 14 and Figure 12). In the case of the hearing subjects, this is a steady increase from grade to grade with a significant increase between grades three and five. On the other hand, in the case of the deaf group there is a continued increase from grade three to grade seven, with a significant increase occurring between grades five and seven, followed by a nonsignificant decline between grades seven and nine. This curve for the deaf group (see Figure 12) reflects the same reversal in the order of the seventh and ninth grade means observed in the findings on the mean numbers of clauses per T-unit; however, in the case of mean T-unit length the decline from grade seven to grade nine is damped somewhat

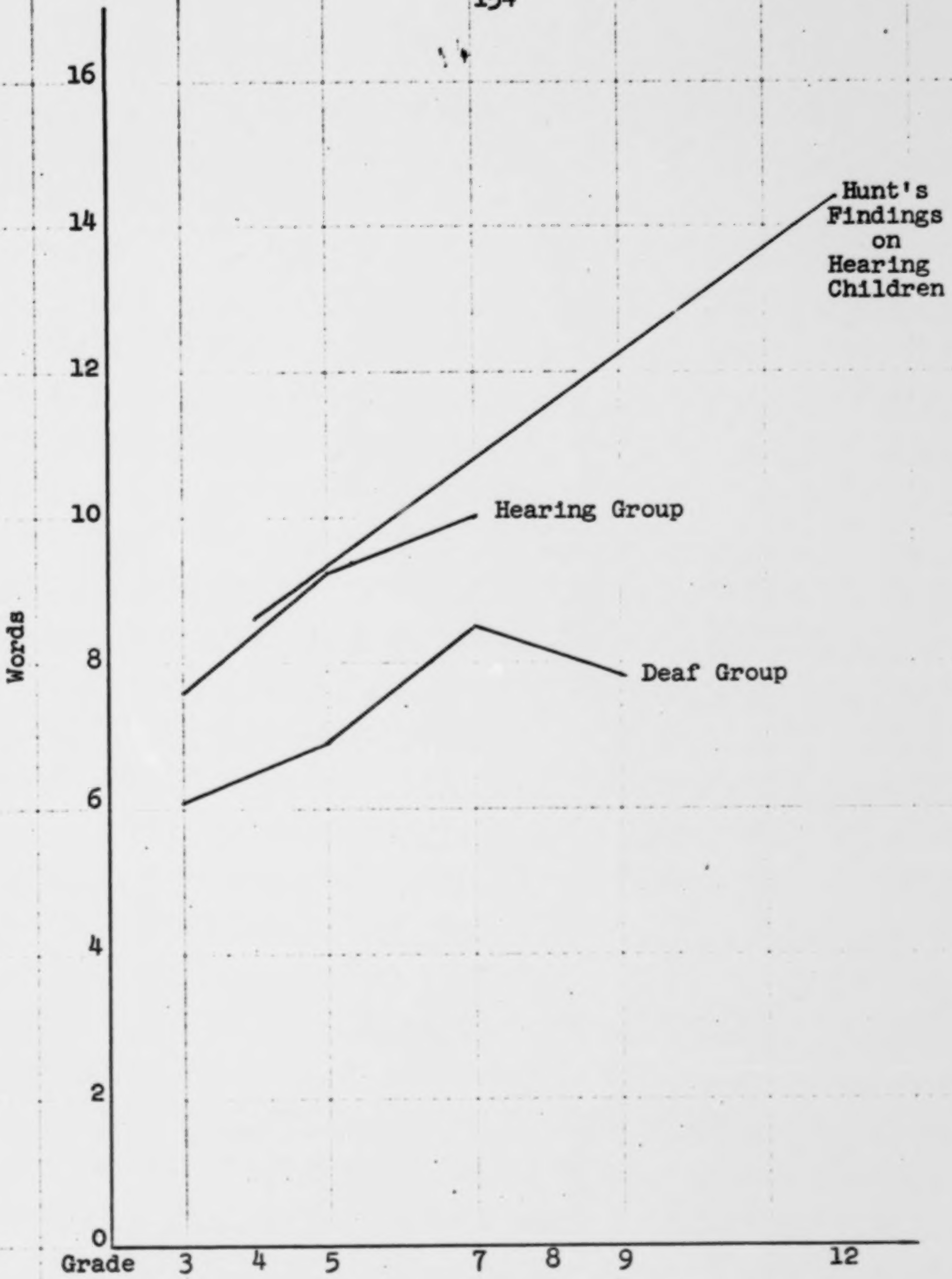

FIGURE 12.--Mean T-unit Length

because mean clause length is slightly greater for ninth graders than for seventh graders.

In his study of the writing of hearing children, Hunt (1965, p. 50) found mean T-unit length to be a better index of language development than either mean clause length or mean sentence, as it reflected the increases in both clause length and amount of subordination in the writing of older students without being inflated by the excessive T-unit co-ordination characteristic of younger writers. The findings of the present study tend to confirm this earlier finding. Mean T-unit length for both the deaf and hearing groups shows a greater increase with advancing grade level than mean clause length, a finding reflected in the slopes of the curves in Figures 10 and 12. Furthermore, the rate of increase from grade to grade is much more constant for mean T-unit length than that for mean sentence length (see Figure 14), an index which because it is influenced by the writers' skill in punctuation fluctuates somewhat erratically.

Not only does mean T-unit length increase at a fairly steady rate for both the deaf and hearing groups in this study, but the rates for two groups appear to be similar. Mean T-unit length increases by 2.37 words between grades three and seven for the hearing group and by 2.46 words during the same interval for the deaf group. Furthermore, the curves of mean T-unit length for the two groups in this study and for the hearing group in Hunt's study (1965) all appear to have roughly parallel slopes, suggesting that the rates of development for the three groups may be similar. However, because of the decline between grades seven and nine in the deaf sample, only the most tentative statements about comparative rates of development can be made on the basis of these findings.

Mean Number of T-Units per Sentence

Whereas the first three of Hunt's synopsis figures--mean clause length, mean number of clauses per T-unit, and mean T-unit length--all show significant increases with advancing grade level for both the deaf and hearing groups, the fourth synopsis figure, mean number of T-units per sentence does not vary significantly between grades in either group. These findings are consonant with those of Hunt's study (1965, p. 51) in which the ratio of T-units to sentence was reported to be nonsignificantly related to advance in grade level.

Although the means for this ratio differ nonsignificantly, it should still be noted that these means increase with advancing grade level in both the deaf and hearing groups. In the hearing group, however, the extremely large within grade variance in grades five and seven suggests that the means are greatly inflated by the performance of a few students, a suggestion which is confirmed by the fact that

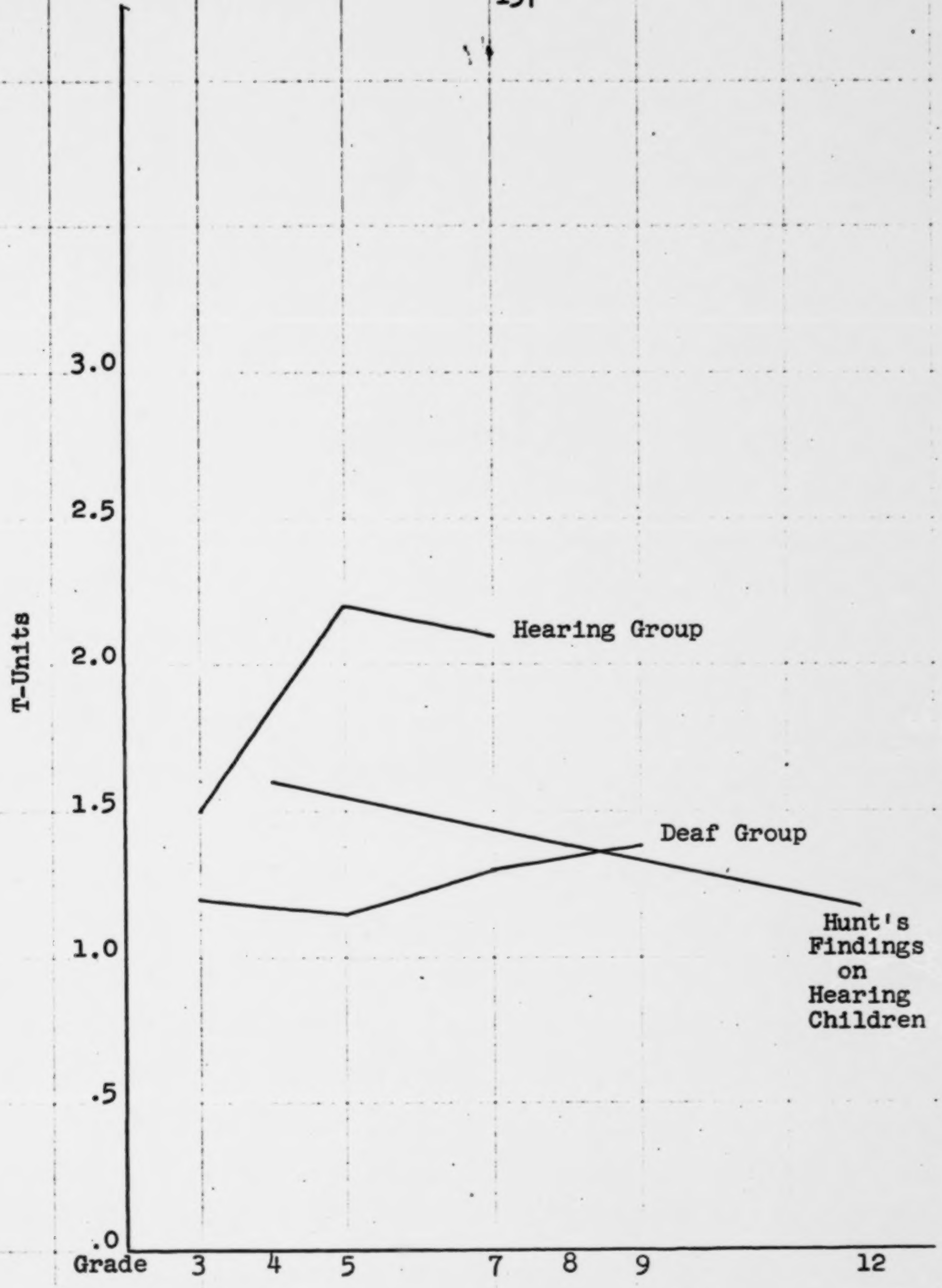

FIGURE 13.--Mean Number of T-units per Sentence

one hearing seventh grader punctuated his entire composition as a single sentence, giving him a mean sentence length of 120 words, and two hearing fifth graders punctuated their compositions as two sentences. Clearly the reliability of the T-units-per-sentence ratio as an index of language development is negatively affected by the fact it can be so easily inflated by an individual writer's lack of skill in punctuating properly.

However, in the case of the deaf group the increase in the number of T-units per sentence cannot be dismissed quite so easily. The within grade variance is much more homogeneous for the deaf group, and the increase, at least between grades five and nine, is fairly steady, indicating that more frequent T-unit coordination may indeed be characteristic of older deaf writers. However, even if such were the case, and there is insufficient evidence in these findings to conclude that it is, the finding of Hunt's study (1965, p. 51) that this ratio declines steadily in the writing of hearing children between grades four and twelve implies that the increase in this ratio observed in the writing of the older deaf writers is a temporary phenomenon characteristic of an intermediate phase of language development.

Mean Sentence Length

The final synopsis figure, mean sentence length, fluctuates erratically with advancing grade level for the hearing group, and a one-way analysis of variance shows the variance attributable to differences between grade means on this variable to be nonsignificant. Like the mean number of T-units per sentence, mean sentence length varies tremendously within grades for the hearing group and it too is contaminated by the punctuation skills of a few writers.

However, mean sentence length for the deaf group shows a fairly steady and significant increase with advancing grade level, with a significant increase occurring between grades five and seven (see Tables 13 and 14 and Figure 14). In fact, for the deaf subjects mean sentence length at first appears to be as good an index of language development as mean T-unit length and perhaps better since it reflects the fact that older deaf writers coordinate T-units more frequently than younger ones. However, evidence from the other synopsis figures and from the transformational analysis of this study implies that the deaf seventh graders' language performance in this sample is indeed more mature than that of the deaf ninth graders, a fact reflected more accurately by T-unit length than by sentence length. Moreover, evidence from Hunt's study suggests that increased frequency of T-unit coordination

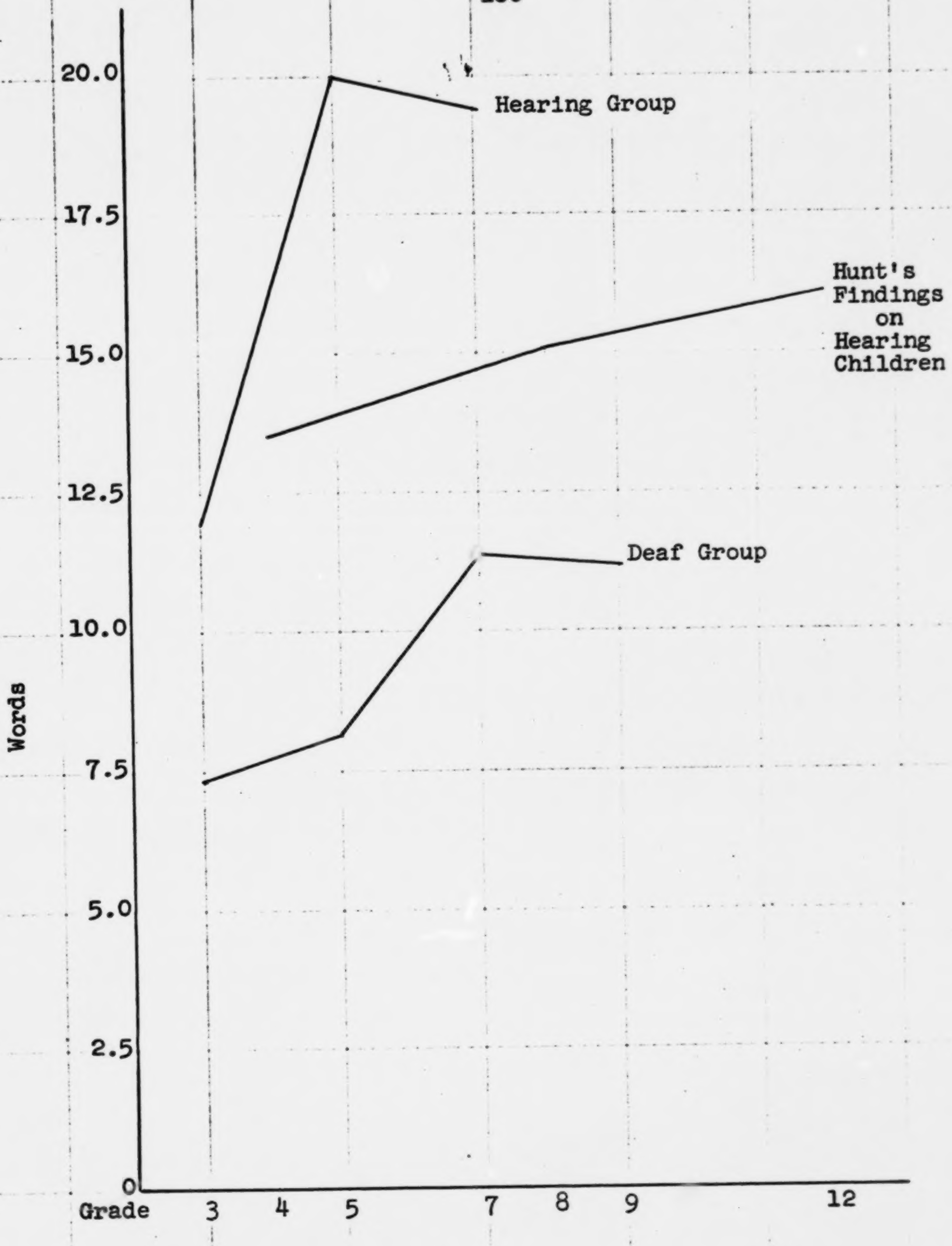

FIGURE 14.--Mean Sentence Length

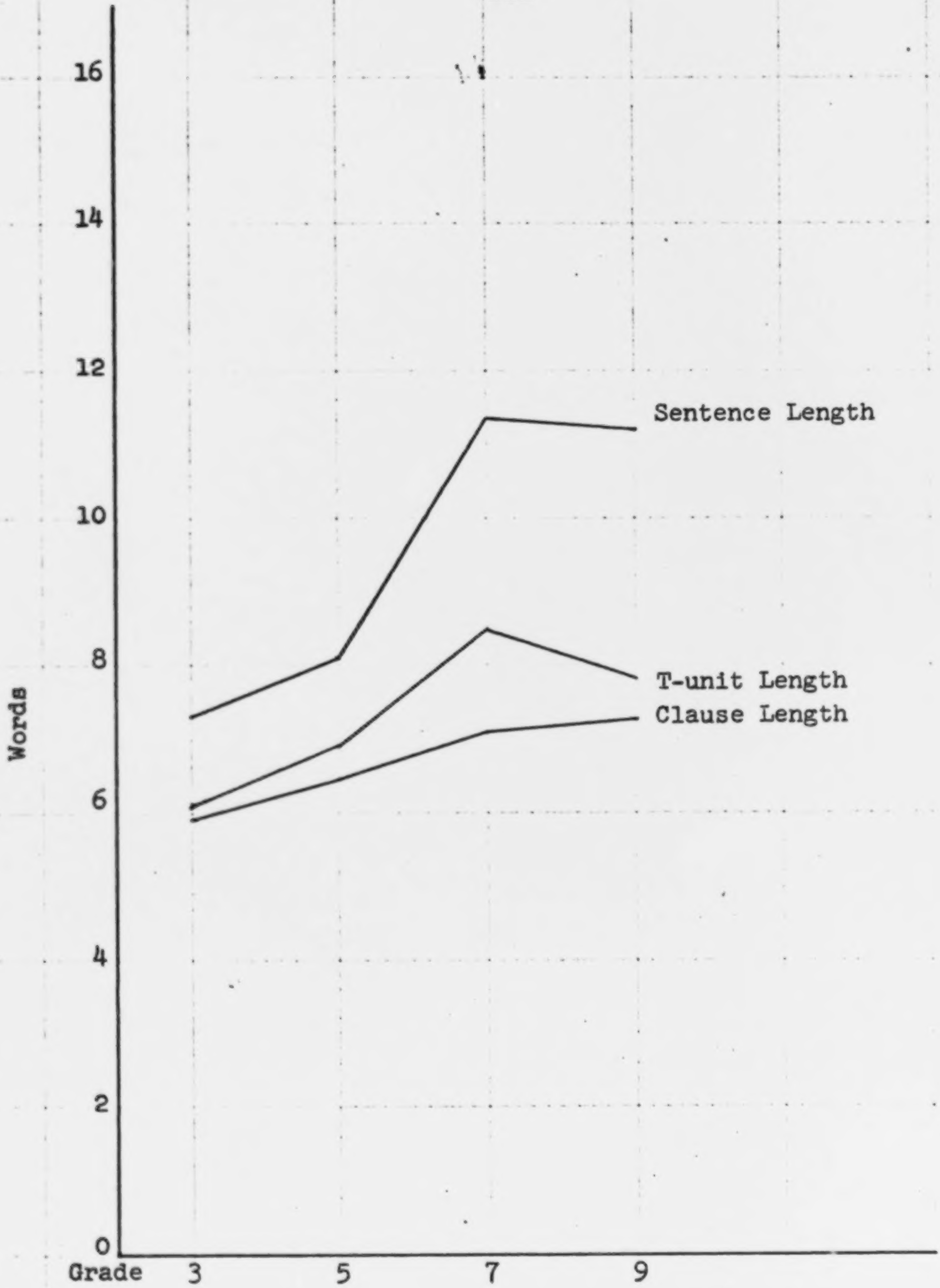

FIGURE 15.--Mean Clause, T-unit and Sentence Lengths for Deaf Group

observed in the writing of older deaf students is a temporary phenomenon, and that such coordinations are not ultimately indicative of greater syntactic maturity. When this counter-evidence is considered, it appears that mean T-unit length is a better gauge of language development than sentence length for the deaf subjects as well as for the hearing.

Summary

1. In both the deaf and hearing groups, mean composition length increased steadily and significantly with advancing grade level. However, the rate of increase was greater for the hearing group than for the deaf, and the mean composition length of the hearing writers exceeded that of the deaf at every grade level.

2. The mean numbers of words excluded as uninterpretable varied nonsignificantly with grade level for both the deaf and hearing groups. However, there was a dramatic difference in the means of this variable between the deaf and hearing groups, with the mean for the deaf group being roughly 40 times as great as that for the hearing group. Thus, although the writing of uninterpretable passages seems to be an idiosyncratic problem of a few writers among both the deaf and hearing groups, it appears to be a much greater problem for deaf writers at all grade levels than for hearing ones.

3. Three of Hunt's synopsis figures mean clause length, mean number of clauses per T-unit, and mean T-unit length showed a significant increase with advancing grade level for both the deaf and hearing groups. However, whereas for the hearing group there was an uninterrupted increase from grade three to grade seven on all three variables, for the deaf group there was an uninterrupted increase from grade three to grade nine only in mean clause length. The means for other two variables, number of clauses per T-unit and T-unit length, increased steadily from grade three to grade seven, and then declined from grade seven to grade nine. This unexpected decline in the performance of deaf ninth graders on these two variables may have been a function of the fact that the ninth grade sample was drawn from a slightly different population than the samples for the other three grades.

4. The means for the remaining two synopsis figures, number of T-units per sentence and sentence length, did not vary significantly with grade level for the hearing group, a finding congruent with the findings of earlier studies (Hunt, 1965), (O'Donnell et al., 1967) that these two variables are much poorer indices of language development than are the other three synopsis figures. However, in the findings on the hearing group the means for these last two variables showed an increase with advancing grade level. Moreover, this increase was statistically significant in the case of sentence length. At first blush,

these findings appear to indicate that for deaf writers sentence length is as good an index of syntactic maturity as T-unit length. However, evidence indicating that the deaf seventh graders in this sample are superior in their language development to the deaf ninth graders, a fact which mean sentence length tends to disguise, and evidence indicating that sentence length is inflated by excessive T-unit coordination and poor punctuation lead the author to conclude that T-unit length is the more reliable index of syntactic growth for the deaf subjects as well as the hearing.

4. The rate of language development as measured by gains in mean clause length and mean T-unit length seemed to be roughly the same for the deaf and hearing groups. However, the peculiar decline in mean T-unit length between grade seven and grade nine in the deaf group, made it difficult to estimate the rate of development for that group on that variable.

CHAPTER VI

FINDINGS FROM THE TRANSFORMATIONAL ANALYSIS

In the transformational phase of the analysis the frequencies of various types of embedded constructions in the writing of the deaf students were compared both within and across grade levels. Within grade levels the frequency of one type construction was compared with the frequency of other constructions, and across grade levels increases or decreases in the mean frequencies of the various constructions were compared. The purpose of these comparisons was to see what order, if any, could be discovered in the deaf children's mastery of the various embedding transformations. Furthermore, the findings of this analysis were compared to the findings of a similar analysis on the writing of hearing children (O'Donnell et al., 1967, pp. 54-71) to discover what similarities and what differences in the use of embedded structures appeared in the language development of the two groups.

The four major types of constructions examined in this analysis were headed nominal constructions, non-headed nominal constructions, adverbial constructions, and coordinate constructions. The headed nominal constructions, with the possible exception of noun + possessive, were all constructions consisting of a head noun plus a relative clause or a reduced relative. The non-headed nominals included nominalized sentences and various complement constructions. The adverbial constructions included movable adverb-clauses, purposive infinitives, and various types of adjective complements. Finally, the coordinate constructions included coordinated nominals, predicates, and modifiers. In the following sections the findings for each of these types will be discussed individually.

Nominal Constructions

Headed Nominals

In the writing of deaf students at all grade levels, headed nominals comprise the largest proportion of embedded constructions of any of the four major types. However, this high frequency of headed nominals at every grade level may be somewhat misleading. The implication of this finding is that deaf children's writing contains more constructions resulting from relative clauses or reduced relatives than from any other type of embedding transformation. However, a look at the breakdown of headed nominals reveals that over half of these constructions at every grade level except the ninth grade are nouns + possessives, constructions which some g-t theoreticians now feel may not be derived from embedded sentences (Chomsky, 1968, pp. 30-33).

TABLE 15.--Mean Numbers of Various Types of Embedded Structures per Hundred T-units in Writing of Deaf

Type of Construction	Grade 3		Grade 5		Grade 7		Grade 9	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Nominal Constructions	21.6	15.8	37.0	21.0	61.6	39.4	54.2	32.2
Adverbial Constructions	3.2	6.9	4.1	5.6	14.4	19.1	9.1	9.5
Coordinate Constructions	18.4	18.1	29.3	15.7	32.3	24.1	34.5	22.1
Other or Unclear	3.6	5.4	1.0	2.7	1.3	2.4	4.1	5.8
Total	46.9	27.2	71.6	33.9	109.0	69.3	102.7	49.5

The findings from the error analysis and from the frequency counts of other types of headed nominals indicating that congenitally deaf children are not facile in their use of relatives and reduced relatives tend to suggest that the comparatively frequent noun + possessive constructions are probably not derived from underlying relative clauses. If possessives are not counted as resulting from an embedding transformation, then the frequency of headed nominals in the writing of the deaf is about equal to that of non-headed nominals and somewhat less than that of coordinations.

The next most frequent types of headed nominal constructions in the writing of the deaf are noun + adjective and noun + prepositional phrase (see Table 16). Since both of these constructions are most easily described in g-t grammar as reduced relatives, one might expect that they would emerge in the child's language development after he had gained confidence in the use of relative clauses. Such, however, appears not to be the case. The frequency of both prenominal adjectives and post nominal prepositional phrases exceeds that of relative clauses at every grade level. Apparently the congenitally deaf child gains control over the abbreviated constructions earlier than he does over the full blown relative.

Other types of headed nominals occur relatively infrequently in the writing of the congenitally deaf, and few developmental trends can be discerned by comparing the frequencies of these constructions either within or across grade levels.

The mean total number of headed nominals increases steadily and significantly with advancing grade level (see Table 16). Moreover, one-way analyses of variance reveal significant differences between the means of four subclasses of headed nominals--noun + noun, noun + possessive, noun + relative clause, and noun + prepositional phrase. The means of all four subclasses show a general increase with advancing grade level, though not a steady one. In all four cases, the seventh grade mean is slightly higher

TABLE 16.--Mean Numbers of Nominal Constructions per Hundred T-Units in the Writing of Deaf Students

Type of Construction	Grade 3		Grade 5		Grade 7		Grade 9	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Headed Nominals	17.2	13.3	24.3	15.1	38.6	28.7	39.9	25.4
Noun + Noun	.4	1.9	.4	1.5	2.2	4.6	2.9	5.4
Noun + Adjective	6.1	9.4	2.8	4.8	6.6	9.3	8.5	12.2
Noun + Possessive	10.1	10.8	14.8	14.3	19.5	18.7	18.4	12.2
Noun + Relative Clause	0.0	0.1	1.0	2.4	4.9	7.1	2.5	7.0
Noun + Prepositional Phrase	.9	2.3	3.0	4.1	5.8	7.3	5.0	6.9
Noun + Infinitive	.4	1.5	.4	1.7	1.1	2.4	.7	1.8
Noun + Participle	.5	2.0	1.0	2.3	2.3	5.5	1.7	4.1
Noun + Adverb	.5	3.2	.2	.9	.6	2.2	.1	.7
Non-headed Nominals	4.1	6.4	12.9	10.5	19.3	15.4	14.4	10.1
Noun Clause	1.2	2.9	3.0	4.5	5.7	7.1	2.1	2.8
Infinitive Phrase	.8	2.4	2.8	4.8	5.4	6.2	5.6	5.2
Gerund	0.0	0.0	1.4	4.7	3.7	5.5	1.9	3.5
Infinitive Complement	1.2	2.6	2.3	4.6	.9	2.3	0.0	0.0
-ING Complement	.3	1.4	2.6	5.1	4.0	6.2	4.2	5.9
Adjective Complement	0.0	0.0	.5	1.6	.2	.9	.1	.5
Total	21.6	15.8	37.0	21.0	61.6	39.4	54.2	32.2

than the ninth grade mean, a phenomenon observed previously in the findings of the quantitative analysis and discussed in Chapter V.

This unexpected reversal in the performance of the deaf seventh and ninth graders, a phenomenon which shows up in the findings on many of the embedded constructions, is probably peculiar to this particular sample and not characteristic of the language development of deaf children generally. A more puzzling phenomenon encountered in comparing the frequencies of the various constructions across grade level is the high frequency of noun + adjective constructions in the writing of deaf third graders. Although the mean number of such constructions increases steadily from grade five through grade nine, suggesting that deaf writers gain increasing control over the use of prenominal adjectives with advancing grade level, the high mean for grade three is quite inconsistent with this developmental trend.

In general, however, the mean total numbers of headed nominals and the means of the subclasses suggest that as the deaf student matures, he gains increasing control over the rules involved in producing nouns + possessives, nouns + relative clauses, and nouns + reduced relatives. The comparatively high frequency of the noun + possessive constructions in the writing of the deaf at all grade levels indicates (1) that such construction may not be derived from a noun plus a relative clause as the other headed nominals probably are, and (2) that the rules for producing the noun + possessive constructions are acquired earlier in the developmental process than those producing the constructions derived from a noun plus a relative.

The findings from the O'Donnell - Griffin - Norris study (see Table 17) on the frequencies of various types of headed nominal constructions in the writing of hearing children also show a preponderance of noun + possessive constructions at every grade level. Apparently, hearing children, too, gain command of this construction earlier and use it more frequently than any of the other headed nominal constructions. However, this preponderance is not nearly so great in the case of the hearing children as in case of the deaf. Whereas in the findings for the deaf group, noun + possessive constructions account for half or more of all headed nominals used, in the findings for the hearing group, noun + possessive constructions account for only about a third of the total number.

Indeed, on this particular variable the performance of the deaf writers comes closer to that of the hearing group than on any other headed nominal construction. Although for all other headed nominals, the mean frequencies of the hearing group far exceed those of the deaf group, for noun + possessive constructions the means of the third and fifth grade deaf are nearly two-thirds those of their hearing peers and the means of seventh and ninth grade deaf are nearly equal to the mean for the seventh grade hearing group.

The second most common headed nominal in the writing of the hearing, the noun + noun construction, occurred quite infrequently in the writing of the deaf (see Tables 16 and 17). However, the third and fourth most frequently occurring constructions in the writing of the hearing, noun + adjective and noun + prepositional phrase, also occurred with relatively high frequency in the writing of the deaf. In the writing of the hearing, as in that of the deaf, relative clauses occurred comparatively infrequently. At every grade level for both the deaf and hearing groups, the frequency of relative clauses was less than that of either prenominal adjectives or post nominal prepositional phrases, constructions presumably derived from underlying relatives. In general, though the findings for the hearing group show the ordering of the subclasses from most frequently occurring to least frequently occurring to be about the same as for the deaf group, the primary exception being the high frequency of noun + noun constructions in the writing of the hearing, constructions occurring only rarely in the writing of the deaf.

The mean total numbers of headed nominals show a steady increase with advancing grade level for the hearing

TABLE 17.--Mean Numbers of Nominal Constructions per Hundred T-units in the Writing of Hearing Students*

Type of Construction	Grade 3 Mean	Grade 5 Mean	Grade 7 Mean
Headed Nominals	41.78	57.86	71.85
Noun + Noun	11.07	13.59	14.56
Noun + Adj.	6.65	10.45	13.39
Noun + Possessive	15.96	21.71	23.07
Noun + Relative Clause	.99	3.37	4.46
Noun + Prepositional Phrase	4.32	5.90	9.93
Noun + Infinitive	.35	.17	.62
Noun + Participle	2.31	2.51	5.31
Noun + Adverb	.13	.16	.45
Non-headed Nominals	16.71	18.57	22.21
Noun Clause	7.75	7.50	7.47
Infinitive Phrase	2.52	2.85	4.41
Gerund	.81	1.31	2.71
Infinitive with Subject	5.89	6.61	7.07
Total	58.49	76.43	94.06

* All data on hearing children in this Chapter comes from O'Donnell et al., 1967, pp. 54-71.

group (see Table 17) as do the means of all the subclasses. This increase suggests the same developmental trend observed in the writing of the deaf group, i.e., that as the writer matures he uses headed nominal constructions more facilely and more frequently. Furthermore, when the means for the deaf and hearing groups are compared, it appears that the rate of development on these variables is about the same for both groups. Although the means for the hearing group exceed those for the deaf group at every grade level, the difference between the two sets of means remains fairly constant across grade level.

Non-headed Nominals

Non-headed nominal constructions or nominalized sentences are comparatively rare in the writing of the deaf at all grade levels as are headed nominal constructions excluding nouns + possessives. Moreover, that such should be the case is quite consonant with findings in the error analysis suggesting that deaf writers have particular difficulty with the rules involved in producing such constructions.

Although all types of nominalizations are used infrequently in the writing of the deaf, the most frequently occurring types across grade levels appear to be noun clauses and infinitive phrases. However, the combined frequency of the various complement constructions is nearly equal to that of noun clauses or infinitives. This somewhat unexpected high frequency of complement constructions may have been a function of the story the writers were narrating, a story in which the characters saw and heard each other doing things. Finally, the relative frequency of gerunds is low at all four grade levels, suggesting that the rules involved in producing such constructions are acquired somewhat later by the deaf writers than those involved in the production of noun clauses and infinitives.

The mean total numbers of non-headed nominal constructions show a general and significant increase with advancing grade level, as do the means of most of the subclasses (see Table 16). However, this increase is not continuous from grade three through nine, but rather the means increase steadily from grade three to grade seven and then decline between grades seven and nine. This is the same reversal in the developmental trend between grades seven and nine which has been observed in findings reported earlier in the study.

The findings of O'Donnell et al. on the frequency of non-headed nominals in the writing of hearing children show such constructions to occur less frequently than headed nominals, even when the noun + possessive constructions are excluded from the latter. Such a finding suggests that hearing children may gain syntactic control over the use of relatives and reduced relatives somewhat earlier than they gain equally sure command over the use of nominalized sentences. There is no parallel evidence in the findings on the deaf group to suggest a similar ordering in the acquisition of rules, possibly because so many of the deaf writers were at a stage of language development where the use of either of these types of transformations posed insurmountable difficulties.

The most frequently occurring non-headed nominals in the writing of the hearing children at every grade level were noun clauses and infinitives with subjects. (The latter are probably roughly equivalent to infinitive complements in the present study.) The least common nominalizations in the writing of the hearing group, as in the writing of the deaf, were gerund constructions. These findings are congruent with the present study's findings on the relative frequency of the various types of nominalizations in the writing of deaf children. Both sets of findings imply that the child learning language acquires command over the use of infinitives and noun clauses at an earlier stage in his language development than he acquires equal skill and confidence in the use of gerunds.

However, one type of non-headed nominal which occurred fairly frequently in the writing of the deaf, the -ING complement, is not even listed in the findings on the hearing children. However, this fact may be a function of differences in the analysis procedures of the two studies rather than a reflection of differences in the language performance of the hearing and the deaf writers. Constructions classified as -ING complements in the present study may have been classified as noun + participle phrase constructions in the O'Donnell-Griffin-Norris study. This would tend to account for the fact that O'Donnell et al. found a proportionally greater number of headed nominals to be noun + participle constructions than this author found in the writing of the deaf.

The findings on the hearing children show that the mean total number of non-headed nominals as well as the means of three of the four subclasses increases steadily with advancing grade level. However, the mean number of noun clauses used by hearing writers is highest in grade three and declines slightly from grade three to grade nine (see Table 17). The implications of these findings seem to be that whereas the hearing student increases his skill in the use of gerunds and infinitives between grades three and nine, he can by the third grade already use noun clauses facilely whenever he needs to. Thus his language development after grade three reflects no further gains in this area.

A comparison of the mean numbers of non-headed nominals written by the deaf and hearing groups shows that the hearing students write more such constructions at every grade level. However, the difference between the two groups is most pronounced at the third grade level, as hearing third graders produced over four times as many nominalized sentences as deaf third graders. The implication here seems to be that very few deaf third graders have reached the point in their language development of being able to use an entire sentence as an NP in another sentence. Nevertheless, between grades three and seven, some deaf writers appear to make considerable progress in this respect. During this interval the mean for the deaf group on this variable increases by 15.2 constructions per hundred T-units whereas the mean for the hearing group increases by only 5.5 constructions per hundred T-units during the same interval. Thus, although the deaf students produce fewer nominalizations at every grade level than the hearing, the number of nominalizations written by deaf students increases at a much greater rate.

Adverbial Constructions

Adverbial constructions were the least common of the four types of embedded constructions in the writing of the deaf at all grade levels. Although all adverbial constructions were used infrequently, adverb clauses and purposive infinitives were used more often than other types of adverbials. In grades three, five, and nine, the mean numbers of purposive infinitives exceeds the means for any other type of adverbial. However, at the seventh grade

TABLE 18.--Mean Numbers of Adverbial Constructions per Hundred T-units in the Writing of the Deaf Group

Type of Construction	Grade 3 Mean	Grade 3 SD	Grade 5 Mean	Grade 5 SD	Grade 7 Mean	Grade 7 SD	Grade 9 Mean	Grade 9 SD
Adverb Clauses	1.1	2.6	1.3	2.8	9.2	16.9	4.0	7.3
Time	.4	1.4	.9	2.5	5.2	9.7	2.5	5.5
Place	0.0	0.0	0.0	0.0	.2	.8	.2	.9
Cause	.7	2.3	.4	1.5	2.1	5.3	1.1	2.6
Comparison	0.0	0.0	0.0	0.0	.7	2.4	.1	.7
Purposive Infinitive	1.8	4.8	2.3	4.1	3.9	6.1	4.2	5.9
Adjective Complement (That -s)	0.0	0.0	0.0	0.0	.3	1.3	.1	.6
Adjective Complement (Infinitive)	.1	.8	.5	1.4	.5	2.4	.7	2.2
Adjective Complement (Rep. phrase)	.1	.6	.2	.9	.3	1.3	.1	.8
Total	3.2	6.9	4.1	5.6	14.4	19.1	9.1	9.5

level, the mean number of adverb clauses is twice as great as the mean for any other adverbial construction used by seventh graders and also more than twice as great as the mean number of adverb clauses for any other grade level. It is in this comparatively frequent use of adverb clauses that the performance of the deaf seventh graders differs most dramatically from that of deaf writers at the other grade levels. However, the extremely large standard deviation for this variable at the seventh grade level (see Table 18) suggests that the seventh grade mean may be greatly inflated by the performance of a few particularly able writers. Among the various types of adverb clauses, time clauses and cause clauses were by the most common at all grade levels. The other types of adverb clauses and the various types of adjective complements were rarely used by deaf writers at any grade level.

The mean total numbers of adverbial constructions used by deaf writers increases with advancing grade level (see Table 18) as do the means of the various subclasses. The developmental curve described by the mean number of adverbials shows a slight increase between grades three and five (.9 constructions per hundred T-units), a tremendous increase between grades five and seven (10.3 constructions per hundred T-units), and then a pronounced decline between grades seven and nine (5.3 constructions per hundred T-units). Because of the seemingly atypical performance of a few seventh graders, it is difficult to generalize about the deaf children's rate of development in the use of adverbial constructions.

The findings of O'Donnell et al. (1967) reveal that hearing children too write fewer adverbial constructions than nominal or coordinate constructions. However, the number of adverbial constructions written at each grade level comprises a greater proportion of the total number of embedded structures for the hearing writers than for the deaf. For the hearing group adverbials account for about 15% of all embedding, whereas for the deaf subjects adverbial constructions account for less than 10% of all embeddings.

Among the hearing writers, adverb clauses were by far the most commonly used adverbial constructions, accounting for over 2/3 of the total number of adverbials at every grade level. Adverbial infinitives ran a poor second to adverb clauses, and sentence adverbials, the least common of the three, were used only infrequently. When these findings on the hearing students are compared to those cited earlier on the deaf subjects, it appears that the relative frequency with which the various adverbial constructions are used is not the same for both groups, as the hearing group produced a preponderance of adverb clauses at every grade level whereas the deaf writers used more adverbial infinitives than adverb clauses in every grade except the seventh.

The relatively high proportion of both nominal and adverbial infinitives found in the writing of the deaf subjects in this study is harmonious with findings of Heider and Heider that infinitive constructions are used relatively frequently by deaf students (1940, p. 62). Why the deaf child should use proportionally more infinitives

TABLE 19.--Mean Number of Adverbial Constructions per Hundred T-units in the Writing of Hearing Students

Type of Construction	Grade 3 Mean	Grade 5 Mean	Grade 7 Mean
Adverb Clauses	8.93	15.65	17.60
Sentence Adverbials	.88	1.41	4.04
Adverbial Infinitives	3.20	1.87	4.13
Total	13.01	19.03	24.29

than the hearing child is not clear. One wonders whether this phenomenon is a function of the type of language instruction and experience to which the deaf child is exposed or whether it is a reflection of the fact that deaf children are able to use certain subclausal constructions more easily and earlier than they are able to use subordinate clauses.

The mean numbers of adverbial constructions increase with advancing grade level for the hearing group (see Table 19) as well as for the deaf, indicating that during this period one facet of language development for deaf and hearing children alike is gaining increased control over the use of various adverbial constructions. However, whereas the rate of development on this variable for the deaf group is quite unsteady, probably because of the atypical performance of the deaf seventh graders, the rate of development on this variable for the hearing group is steady and impressive.

Coordinate Constructions

Both the deaf group in the present study and the hearing group in the O'Donnell-Griffin-Norris study used coordinate constructions somewhat less frequently than nominal constructions and more frequently than adverbial constructions at every grade level. Moreover, the majority of the coordinate constructions written by both groups were coordinated predicates. The next most common coordinate constructions in the writing of both groups were coordinated nominals, the least common, coordinated modifiers. Thus, it appears that the relative frequency of the various types of coordinate structures used is about the same for both the deaf and hearing groups.

The mean number of coordinate constructions used is greater for the hearing than the deaf at every grade level (see Table 29); however, these differences between the deaf and hearing groups are less pronounced for this variable than for any of the other embedded constructions. Apparently the deaf children come closer to matching the hearing children in their ability to coordinate constituents than in the use of any of the other sentence combining transformations. This finding is consonant with findings reported from the error analysis in suggesting that the rules involved in producing coordinate constructions are acquired earlier and more easily than other sentence combining transformations.

TABLE 20.--Mean Numbers of Coordinations per Hundred T-units in the Writing of the Deaf Group

Type of Construction	Grade 3		Grade 5		Grade 7		Grade 9	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Coordinated Nominals	3.0	4.8	1.4	2.9	2.7	4.0	1.9	3.6
Coordinated Predicates	15.2	17.0	27.1	15.5	29.4	24.8	31.9	22.3
Coordinated Adjectives	0.0	0.0	0.0	0.0	.1	.6	.1	.5
Coordinated Adverbs	.2	.8	.6	1.3	.3	1.4	.6	2.4
Total	18.4	18.1	29.3	15.7	32.2	24.1	34.5	22.1

The curve of the mean number of coordinations across grade levels for the hearing group tends to support the notion that the rules involved in coordinating constituents are firmly incorporated into the child's repertoire comparatively early in the language development process. The mean number of coordinations for the hearing group more than doubles between grades three and five, and then declines slightly between grades five and seven(see Table 21). The fact that the mean frequency of coordination peaks at the

TABLE 21.--Mean Number of Coordinate Constructions per Hundred T-units in the Writing of Hearing Students

Type of Construction	Grade 3 Mean	Grade 5 Mean	Grade 7 Mean
Coordinate Nominals	4.19	7.75	9.71
Coordinate Modifiers	1.90	3.35	2.78
Coordinate Predicates	14.29	33.43	29.32
Total	20.35	44.61	41.81

TABLE 22.--Mean Number of Embedded Structures in Writing of Hearing per Hundred T-units

Type of Construction	Grade 3 Mean	Grade 5 Mean	Grade 7 Mean
Nominal Constructions	58.5	76.4	94.1
Adverbial Constructions	13.0	19.0	24.3
Coordinate C Constructions	20.4	44.6	41.8
Total	91.9	140.0	160.2

fifth grade level implies that most hearing fifth graders are as competent as they will ever be in process of coordinating structures and that further language development will probably be in increasing the frequency of other types embedded constructions.

On the other hand, the mean number of coordinations in the writing of the deaf group shows an uninterrupted increase between grades three and nine. However, the mean frequency of coordinations for deaf ninth graders (34.5 coordinations per hundred T-units) is still less than the mean frequency for hearing fifth graders (44.61 coordinations per hundred T-units). Although the rate of increase declines at the upper grade levels for the deaf group, there is no reversal of the developmental trend observed in the curve for the hearing group. These findings suggest that although the process of coordinating constituents is learned comparatively early by both deaf and hearing children, the deaf still lag behind the hearing in this aspect of language development.

Summary

1. The means for the hearing comparison group exceed those for the deaf group on every variable examined in the transformational analysis. That is, the writing of the hearing students contains greater frequencies of virtually every type of embedded construction at every grade level than that of the deaf subjects. However, the amount by which the means for the hearing group exceed those for the deaf is not constant across variables, but rather is most pronounced for adverbial constructions, and least pronounced for coordinate constructions.

2. In the writing from both the deaf and hearing groups, the mean numbers of nearly all types of embedded constructions increase with advancing grade level. Two exceptions to this general trend are the mean frequencies of noun clauses and coordinate constructions in the writing of the hearing group. For both of these variables the peak frequency is reached before the seventh grade level, suggesting that skill and confidence in the use of these two constructions come somewhat earlier in the language development

process than is the case for other types of embedded structures. However, the increase in the means of the overwhelming majority of the variables with advancing grade level indicates that for most students, both hearing and deaf, gaining control over the use of constructions formed by sentence combining transformations is an important part of their language development.

3. A comparison of the relative frequency with which various subclasses of nominals, adverbials, and coordinations are used reveals that the proportional distribution of embeddings among the various subclasses is approximately the same for the deaf and hearing groups. One exception to this general finding is that deaf writers use proportionally more adverbial infinitives than the hearing writers whereas the hearing use proportionally more adverb clauses than the deaf. Similarly deaf children use proportionally more subclausal nominal structures, particularly infinitives, than hearing children while hearing children use proportionally more noun clauses and relative clauses than deaf ones. Finally, the noun + possessive construction comprises a much

greater proportion of headed nominals written by deaf children than headed nominals written by hearing ones.

CHAPTER VII

CONCLUSIONS AND IMPLICATIONS FOR FUTURE RESEARCH

Conclusions

Order of Language Acquisition

The order in which both the deaf child and the hearing child acquire the rules of their language is not a sequence of discrete stages during which a single rule or type of rule is being acquired while other aspects of language development remain constant. Instead, for the deaf and hearing child alike the process of language acquisition is a complex one in which various types of rules are being acquired simultaneously, and changes in one part of their evolving grammars may effect changes in another part. Thus the order in which rules are acquired refers to the two following phenomena: (1) the order in which the child first gives some evidence in his language performance that he is trying to use a particular rule, and (2) the order in which a child's language performance first indicates that he has correctly internalized a particular rule as evidenced by his consistent production of well formed structures involving this rule.

When order of acquisition is viewed in this way, the findings of the present study suggest certain generalizations which can be made about the order in which the deaf child acquires the rules of his language:

1. Two strict subcategorial rules appear to be acquired quite early in the language development process, namely, S NP + VP and $\begin{matrix}\text{Copula + X}\\ \text{VP + (X)}\end{matrix}$. The evidence on which this conclusion is based is that very few deaf third graders omitted subjects, verbs or copulas in their writing, and virtually no deaf subjects above the third grade made such omissions.

2. In the early stages of language development some congenitally deaf children's only rule for expanding VP may be VP V (NP) (NP). The evidence for such a generalization is that a number of deaf subjects consistently omitted prepositions from constructions such as datives and locatives, constructions generally expressed in prepositional phrases in English. However, the frequency of such omissions was highest for third graders and declined significantly between grades three and five, implying that during this interval many deaf children modify their rule for expanding VP to include prepositional phrases as possible constituents.

3. After acquiring rules to introduce prepositions into the VP, the deaf child must then learn in exactly what contexts the rules apply. Failure to learn the strict subcategorial feature specifications of individual lexical

items may result in an overspreading of the rule introducing prepositions and hence in the use of redundant prepositions. Evidence that learning the strict subcategorial features of individual lexical items occurs later in the developmental process than the acquisition of the general rule introducing prepositions in certain contexts comes from the finding that while the frequency of preposition omissions declined sharply between grades three and five, and remained fairly constant thereafter, the frequency of redundant prepositions increased sharply between grades five and seven and declined only slightly between grades seven and nine.

4. The process of acquiring the various strict subcategorial rules appears to span the entire developmental interval sampled. However, the sharp decline in the frequency of strict subcategorial errors between grades three and five, and the less sharp decline thereafter suggests that more progress is made by most deaf students in the first half of the interval and that after grade five acquisition of strict subcategorial rules proceeds at a slower rate. This decelerating rate of acquisition in the upper grades suggests that those students who are still making errors in the use of the more general strict subcategorial rules are less able than those who have mastered them by grade five, and that those rules still violated in the upper grades by large numbers of students are more idiosyncratic than those rules generally mastered before grade five.

5. Major categorial errors appear to result in less deviant constructions than would have been predicted on the basis of the grammatical theory presented in Aspects of the Theory of Syntax (Chomsky, 1965, pp. 148-153). This finding suggests that such errors may result from the violation of relatively low level rules of lexical insertion. However, the findings from this study give no indication as to when such rules are mastered, as the frequency of major categorial errors committed appears to be unrelated to grade level.

6. The rules involved in generating the minor categories, determiners and auxiliaries, appear to be acquired by deaf children later than those introducing the major categories. Furthermore, the high frequency of errors in the use of these two categories suggests that the rules introducing them are acquired only slowly and with considerable difficulty. However, the fact that the frequency of such errors declines with advancing grade level implies that many students are making progress toward mastering these rules during the developmental span sampled in this study.

7. Evidence from both the error analysis and the transformational analysis indicates that deaf children begin to acquire the various sentence combining transformations only after they have gained a certain command over the phrase structure rules of the grammar. This is not to

imply that the deaf child masters the P. S. rules so perfectly that his writing is free from strict subcategorial errors before he begins to attempt embedding one sentence within another. However, the fact that the writing of some of the youngest deaf subjects contained both the highest frequencies of P. S. rule violations and morphological errors and no instances of constructions resulting from sentence combining transformations suggests that these writers may have been at a pre-transformational stage in their language development, during which language acquisition consisted primarily of mastering phrase structure and morphological rules.

8. Of the various types of sentence combining transformations, the rules involved in coordinating constructions appear to be acquired earliest by the deaf child. The rules involved in producing nominalizations, relatives, and adverb clauses appear to be acquired much later than the coordination transformations and with much greater difficulty.

9. Like transformational rules, morphological rules seem not to be acquired by the deaf child in the earliest stages of his language development. This inference is based on the fact that a few deaf third graders used no inflectional endings in their writing and others used such endings infrequently and inconsistently. However, for most deaf subjects sampled even at the third grade level,

the process of acquiring the morphological rules of the language was already well underway. Moreover, the significant decline in morphological errors between grades three and nine indicates that much progress is made in this aspect of language development during this period.

The order in which the morphological rules are acquired by the deaf child appears to be from most general to most idiosyncratic. Evidence that the most general morphological rules are acquired first and the least general rules and exceptions learned last comes from the finding that many deaf children in the process of acquiring these rules overspread the general rule to cases where it does not apply.

A comprehensive view of the order in which the various types of rules seem to be acquired by the deaf child suggests that there may indeed be some relationship between the ordering of the rules in a theoretical description of the generative process and the order in which rules are acquired by the deaf child learning language, with rules occurring early in the generative process generally being acquired earlier than rules occurring later. For example, the late emergence of determiners, auxiliaries and prepositions as compared to nouns and verbs suggests that the deaf child acquires the rule $S \rightarrow NP + VP$ before he acquires the full complement of rules for expanding NP and VP. Similarly the high frequency of kernel sentences in the writing of the deaf third graders and the concomitant low frequency of embedded constructions imply that the deaf child acquires a fairly simple phrase structure grammar before he begins to acquire the various sentence combining transformations.

However, there are obvious exceptions to this pattern of high level rules being acquired earlier than low level rules. One such exception is that most deaf children begin to acquire morphological rules earlier than they begin to produce embedded constructions. Thus in this instance the low level morphological rules appear to be acquired earlier than higher level transformational ones. Furthermore, some deaf children are able to conjoin predicates correctly before they have acquired the rules for introducing determiners. If the rules involved in introducing determiners are regarded as P. S. rules, then these children appear to acquire some transformational rules earlier than certain phrase structure rules.

The order in which the deaf child acquires the rules of his language seems to be similar in a number of respects to that observed in much younger hearing children. For example, the findings in the present study indicating that deaf children acquire morphological rules and rules introducing the minor categories later than they acquire the rules generating nouns and verbs is consonant with the findings that hearing children consistently omit inflections and function words in the early stages of their language development. Furthermore, findings in the present study that deaf children acquire rules introducing prepositions somewhat later than they acquire rules introducing nouns and verbs is paralleled by findings indicating that hearing children, too, omit prepositions in the early stages of language development. Finally, findings on the language development of both groups show sentence combining transformations to be acquired somewhat later than phrase structure rules.

However, there are certain respects in which the language development of the two groups appears to differ. One of the most striking differences is in length of time it takes the two groups to master certain rules. Although both deaf and hearing children begin to acquire the rules introducing determiners later than the rules introducing nouns, many hearing children are already using determiners at the two-word stage and most hearing children appear to gain full control over the rules introducing determiners relatively early in their language development. On the other hand, many deaf ninth graders have not fully acquired the rules of the determiner system even after ten or more years of formal language instruction and even though they have acquired other seemingly more difficult language skills such as various sentence combining transformations. Similarly, preposition omissions and morphological errors persist much longer in the writing of the deaf than in the speech and writing of hearing children, suggesting that certain strict subcategorial rules and morphological rules are acquired much more slowly by the deaf child than by the hearing. As a result, the deaf child's acquisition of these rules overlaps his acquisition of more complex transformational rules, a phenomenon probably quite rare in the language development of hearing children.

Nevertheless, the similarities observed in the order of language acquisition of the two groups appear to outweigh the differences. Thus the author concludes that the order in which the congenitally deaf children acquire the rules of their language is fundamentally the same as that of hearing children despite the drastic differences in the language experience of the two groups.

Rate of Language Development

As there are no standard units in which language development can be measured such as miles per hour or words per minute, conclusions about the rate of language development of congenitally deaf children must be based on a comparison of changes in their performance over time with that of a normative hearing group. In this study, there were three areas of language performance in which changes with advancing grade level were compared between the two groups--number of errors per hundred words, mean clause and T-unit length, and number of embedded constructions per hundred T-units.

On the first measure, number of errors per hundred words, the language development of the congenitally deaf proceeded at a much greater rate between grades three and nine than that of the hearing comparison group. The congenitally deaf writers significantly reduced the frequency of errors in their writing with advancing grade level, making particular progress in reducing the numbers of strict subcategorial, minor categorial and morphological errors during this period. On the other hand, although the decline in the frequency of errors made by the hearing group between grades three and seven was statistically significant, it was less than one-third the size of the decline observed in the findings for the deaf group over the same interval.

However, interestingly enough, both the deaf and hearing groups reduced the frequency of errors in their writing at greater rate between grades three and five than they did in the upper grades. Therefore, it appears that the rate of error reduction for both deaf and hearing writers is a function the stage of language development in which the writer finds himself. In the early stages of language development, errors are reduced relatively quickly. However, in the later stages of language development, as the child's writing approaches the asymptote of error-free performance, errors are reduced at an ever declining rate.

Thus the comparative rates of error reduction for the hearing and deaf groups in this study reflect the fact that the hearing children are at much more advanced stage of language development than their deaf peers.

The rate of increase in clause length with advancing grade level appears to be slight but steady for both the deaf and hearing groups. Furthermore, the rate of increase on this variable appears to be roughly the same for both groups although findings from the error analysis and the transformational analysis indicate that the sources of this increase are not the same for the two groups.

On the other hand, findings on the mean T-unit length for the deaf and hearing groups in this study present no conclusive picture on comparative rates of development. When the findings on the third, fifth and ninth grade deaf are compared to the findings on the hearing group, it appears that hearing students increase the frequency of subordinate clauses per T-unit and hence increase T-unit length at a slightly faster rate than deaf students. However, as the findings on the seventh grade deaf are quite inconsistent with the above generalization, no reliable conclusions about rate of increase on this variable can be reached on the basis of the findings from this study.

On the third variable used as a basis for comparing rate of language development, number of embedded constructions per hundred T-units, the total increase from grades three to seven appears to be about the same (roughly 70 constructions per hundred T-units) for both the deaf and hearing groups. However, a closer look at the developmental curves presented by the findings on this variable indicates that the rate of increase for the two groups may not be as similar as at first appears. In the first place, the rate of increase for the hearing group is greatest between grades three and five and declines between grades five and seven, whereas the reverse is true for the deaf group. Furthermore, between grades seven and nine the number of embedded constructions per hundred T-units used by deaf students decreases rather than increases, suggesting that the increase in such constructions between grades three and seven may be inflated by the somewhat atypical performance of the deaf seventh graders in this sample. Thus the findings of this study offer inconclusive evidence about how the rate at which congenitally deaf children increase the frequency of embedded constructions in their writing compares to that of hearing children.

Implications for Future Research

The findings of the present study indicate that the techniques of analysis used in this research can be revealing in describing the language development of children in the process of acquiring the rules of their language. Therefore the author feels that it would be fruitful to use these techniques in analyzing the language performance of other samples of children from both deaf and hearing populations. In particular, the author feels that subsequent research in the following four areas would provide valuable bases of comparison for the findings in the present study and at the same time contribute to what is now known both about the language development of the deaf and about language development in general:

1. The techniques described in the present study should be used to analyze the speech of hearing children between the ages of three and six. The findings from such an analysis would not only provide much needed normative data on how hearing children acquire the rules of their language, normative data against which the findings on the language development of the deaf could be compared, but would also fill in some of the gaps in what is currently known about the language development of the hearing child.

2. A longitudinal study should be done on the language development of the deaf, using the techniques described in the present study to analyze the language performance of a given sample of children at various stages in their development. Since the case history and language experience of every deaf child is so idiosyncratic, such a longitudinal approach would probably give a more reliable

picture of the deaf child's language development than a cross sectional study such as the present one.

3. As the comprehensive scope of the present research did not permit in-depth studies of the acquisition of individual rules, detailed studies could profitably be done on the acquisition by both deaf and hearing children of strict subcategorial rules, minor categorial rules and transformational rules. Such studies (Berko, 1958), (Cooper, 1965) have already been done on children's acquisition of morphological rules with quite fruitful results.

4. Finally, the most intriguing question posed by the findings of the present study is whether or not the order and rate of language development of the congenitally deaf child can be significantly affected by the type of language instruction to which he is exposed. To answer this question, a comparative study of the language development of deaf children exposed to various types instruction should be conducted, using the measures established in the present study as a basis of comparison.

APPENDICES

APPENDIX A

Name

Grade

Age

In your own words tell the story of "The Ant and the Dove".

Figure 1 - Test Sheet

Error Summary Sheet

____
Name

1. Strict Subcategorial ______________
   Omission of Direct Object ______
   Omission of Preposition ______
   Redundant Preposition ______
   Other ______

2. Major Categorial ______________

3. Minor Categorial ______________
   Determiner Omission ______
   Aux. Omission or Error ______
   Def.-Indef. Error ______
   Other ______

4. Transformational ______________
   Conjoining ______
   Nominalization ______
   Relative ______
   Other ______

5. Selectional ______________
   Preposition-Noun ______
   Subject-Verb ______
   Verb-Obj. ______
   Other ______

6. Morphophonemic ______________
   Verb Inflections ______
   Singular-Plural ______
   Possessive ______
   Other ______

7. Order ______________
   Subject-Verb reversal ______
   Verb-Object reversal ______
   Adj. Noun reversal ______
   Other ______

8. Other ______________
   (Fact, etc.)

Figure 2 - Error Summary Sheet

Nominal Structures ________
- Headed ________
  - N + N ________
  - N + Adj. ________
  - N + Poss. ________
  - N + Rel. Cl. ________
  - N + Prep. Ph. ________
  - N + Int. Ph. ________
  - N + Part. Ph. ________
  - N + Adv. ________

- Non Headed ________
  - Noun Cl. ________
  - Infinitive ________
  - Gerund ________

- Complements
  - Inf. ________
  - -ing ________
  - Adj. ________

Adverbal Structures ________
- Adv. Cl. ________
  - Time ________
  - Place ________
  - Manner ________
  - Cause ________
  - Condition ________
  - Degree ________

Purposive Inf. ________
Adj. Comp. ________
- That-s ________
- Inf. ________
- Prep. Ph. ________

Coord. Structures ________
- Nominals ________
- Preds. ________
- Adj. ________
- Adv. ________

Other ________

Total ________

Figure 3 - Summary of Embeddings

APPENDIX B

Complete List of Variables

1. Words per clause
2. Clauses per T-unit
3. Words per T-unit
4. T-units per sentence
5. Words per sentence
6. Composition length
7. Errors per hundred words
8. Words excluded per hundred words written
9. Strict subcategorial errors per hundred words
10. Direct object omissions per hundred words
11. Preposition omissions per hundred words
12. Redundant prepositions per hundred words
13. Major categorial errors per hundred words
14. Minor categorial errors per hundred words
15. Determiner omissions per hundred words
16. Auxiliary errors and omissions per hundred words
17. Definite-indefinite errors per hundred words
18. Transformational errors per hundred words
19. Conjoining transformational errors per hundred words
20. Nominalization transformational errors per hundred words
21. Relativization transformational errors per hundred words
22. Other transformational errors per hundred words
23. Selectional errors per hundred words
24. Subject-verb selection errors per hundred words
25. Other selection errors per hundred words
26. Morphological errors per hundred words
27. Verb inflection errors per hundred words
28. Verb inflection omissions per hundred words
29. Verb inflections overgeneralized per hundred words
30. Tense shifts per hundred words
31. Singular-plural errors per hundred words
32. Plural inflection omissions per hundred words
33. Redundant plural inflections per hundred words.
34. Errors in morphographemic shape of noun stem per hundred words
35. Possessive inflection errors per hundred words
36. Order errors per hundred words
37. Subject-verb reversals per hundred words
38. Verb-object reversals per hundred words
39. Other order errors per hundred words
40. Other errors per hundred words
41. Nominal structures per hundred T-units
42. Headed nominal structures per hundred T-units
43. Noun + Noun structures per hundred T-units
44. Noun + adjective structures per hundred T-units
45. Noun + Possessive structures per hundred T-units

46. Noun + relative clause structures per hundred T-units
47. Noun + prepositional phrase structures per hundred T-units
48. Noun + infinitive structures per hundred T-units
49. Noun + participle structures per hundred T-units
50. Noun + adverb structures per hundred T-units
51. Non-headed nominal structures per hundred T-units
52. Noun clauses per hundred T-units
53. Nominal infinitives per hundred T-units
54. Gerunds per hundred T-units
55. Infinitive complements per hundred T-units
56. -ING complements per hundred T-units
57. Adjective complements per hundred T-units
58. Adverbial structures per hundred T-units
59. Adverb clauses per hundred T-units
60. Time clauses per hundred T-units
61. Place clauses per hundred T-units
62. Cause clauses per hundred T-units
63. Condition clauses per hundred T-units
64. Manner clauses per hundred T-units
65. Comparison clauses per hundred T-units
66. Degree clauses per hundred T-units
67. Purposive infinitives per hundred T-units
68. That-S adjective complements per hundred T-units
69. Infinitive adjective complements per hundred T-units
70. Prepositional phrase adjective complements per hundred T-units
71. Coordinate structures per hundred T-units
72. Coordinate nominals per hundred T-units
73. Coordinate predicates per hundred T-units
74. Coordinate adjectives per hundred T-units
75. Coordinate adverbs per hundred T-units
76. Other embedded structures per hundred T-units
77. Total embedded structures per hundred T-units

APPENDIX C

List of Mean Numbers of Errors per Hundred Words in Writing of Hearing Children

Type of Error	Grade 3		Grade 5		Grade 7	
	Mean	SD	Mean	SD	Mean	SD
Strict Sub categorial	.91	1.41	.41	.53	.46	.61
Direct Object omission	.20	.63	.67	.21	.09	.19
Preposition omission	.18	.48	.04	.12	.04	.14
Redundant Prepositions	.03	.17	.02	.10	.02	.10
Major Categorial	.18	.68	.00	.00	.00	.00
Minor Categorial	.30	.69	.12	.27	.31	.64
Determiner omissions	.17	.55	.09	.23	.22	.52
Aux. Omissions	.04	.23	.00	.00	.00	.00
Definite-Indefinite	.00	.00	.00	.00	.00	.00
Transformations	.60	1.11	.40	.60	.42	.56
Conjoining	.17	.59	.20	.46	.23	.35
Nominalization	.25	.67	.00	.00	.03	.13
Relativization	.03	.15	.01	.05	.08	.17
Other Transformational	.06	.32	.18	.37	.09	.21
Selectional	.04	.21	.02	.13	.03	.10

List of Mean Numbers of Errors per Hundred Words in Writing of Hearing Children (Continued)

Type of Error	Grade 3		Grade 5		Grade 7	
	Mean	SD	Mean	SD	Mean	SD
Subject-verb selection	.00	.00	.00	.00	.00	.00
Other selectional	.04	.21	.02	.13	.03	.10
Morphological	2.47	2.87	1.72	1.68	1.42	1.41
Verb Inflection	1.22	2.08	.97	1.09	.74	1.03
Verb Omissions	.96	1.83	.55	.97	.38	.88
Verb Over-generated	.00	.00	.00	.00	.00	.00
Tense Shift	.03	.14	.12	.32	.14	.30
Singular-Plural	.57	1.06	.35	.60	.51	.54
Plural Inflection omission	.13	.41	.08	.21	.11	.35
Redundant Plural inflection	.00	.00	.00	.00	.00	.00
Improper Noun stem	.44	.86	.24	.46	.30	.43
Possessive	.00	.00	.00	.00	.00	.00
Order	.12	.39	.05	.14	.01	.05
Subject-Verb reversal	.09	.36	.01	.07	.00	.00
Verb-Object reversal	.00	.00	.00	.00	.00	.00
Other Order	.03	.17	.03	.13	.01	.05
Other	1.34	1.87	.75	.85	.34	.34
Total	5.93	5.84	3.54	2.86	3.05	2.72

List of Mean Numbers of Errors per Hundred Words in Writing of Hearing Children (Continued)

Type of Error	Grade 3		Grade 5		Grade 7	
	Mean	SD	Mean	SD	Mean	SD
Subject-verb selection	.00	.00	.00	.00	.00	.00
Other selectional	.04	.21	.02	.13	.03	.10
Morphological	2.47	2.87	1.72	1.68	1.42	1.41
Verb Inflection	1.22	2.08	.97	1.09	.74	1.03
Verb Omissions	.96	1.83	.55	.97	.38	.88
Verb Over-generated	.00	.00	.00	.00	.00	.00
Tense Shift	.03	.14	.12	.32	.14	.30
Singular-Plural	.57	1.06	.35	.60	.51	.54
Plural Inflection omission	.13	.41	.08	.21	.11	.35
Redundant Plural inflection	.00	.00	.00	.00	.00	.00
Improper Noun stem	.44	.86	.24	.46	.30	.43
Possessive	.00	.00	.00	.00	.00	.00
Order	.12	.39	.05	.14	.01	.05
Subject-Verb reversal	.09	.36	.01	.07	.00	.00
Verb-Object reversal	.00	.00	.00	.00	.00	.00
Other Order	.03	.17	.03	.13	.01	.05
Other	1.34	1.87	.75	.85	.34	.34
Total	5.93	5.84	3.54	2.86	3.05	2.72

APPENDIX D

Synopsis of "The Ant and the Dove"

The film begins with a panoramic shot of a wooded scene and slowly focuses in on a little ant dressed in cap and boots who is rolling a round object, possibly a cookie, down a hill toward his home. The ant pulls the round object through a hole into his underground home, rolls it down the hall and stores it in the main room alongside several other similar discs. After checking to see what time it is, the ant goes back outside, ostensibly to look for more food. As he walks along the forest path, the ant encounters a snail that gives him a ride piggy-back to the top of a stump. From there, the ant jumps to the back of a passing dragonfly and flies off through the woods.

Soon, though, the wind becomes too strong for the ant, and he is blown off into a pond below. Apparently unable to swim, the ant flounders about in the water calling for help till a dove in a nearby tree notices the ant's dilemma. The dove hesitates for a moment as if thinking and then flies off to get a leaf which she drops to the ant in the pond. The exhausted ant climbs onto the leaf and floats to safety.

Once on dry ground, the ant thanks the dove for rescuing him, picks up another round object and heads for home. On the way home, he breaks the disc, but he tosses all the pieces into his burrow and repairs the round object before retiring for the night.

At this point the film shifts scenes and shows a hunter entering the woods. The hunter shoots apples off a tree, possibly for target practice, until one hits him on the head. Then the hunter walks on through the woods, ostensibly in search of game. As the hunter passes near the ant's home, the sound of his footsteps rouses the ant, who peers out of his hole and then follows the hunter.

Before long the hunter spies the dove sleeping in a tree and begins to take aim. The ant, realizing that his friend is in grave danger, races back to his home for a pair of pinchers which he uses to pinch the hunter on the knee. The pinch on the knee causes the hunter either to shout out or to shoot and miss. At any rate, the dove is awakened and flies to safety. After rubbing his leg, the hunter limps away.

The film then ends with a scene in which the dove returns to thank the ant, and the ant smiling broadly acknowledges the dove's thanks.

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